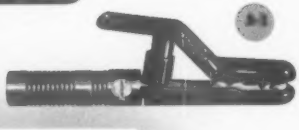
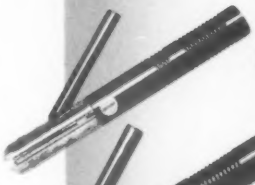
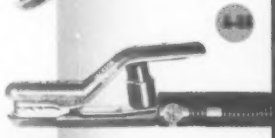
35¢

AUGUST, 1951

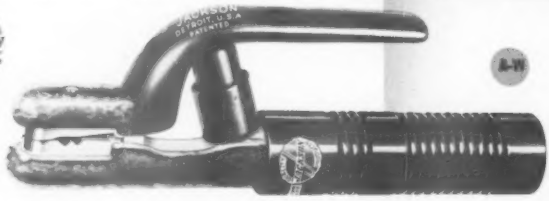






MAXIMUM CAPACITY AMPS	ROD SIZE	MODEL	PRICE*	DESCRIPTION	TONGS MADE OF	
300	1/4	A-1	5.50	INSULATED COPPER ALLOY MODELS	98% COPPER ALLOY HEAT TREATED FOR SUPERIOR STRENGTH HARDNESS CONDUCTIVITY	FULLY INSULATED
500	3/8	A-3	7.00			
500	3/8	A-3S	7.50			
300	1/4	AA-1	6.00	COPPER ALLOY MODELS WITH REPLACEABLE LOWER JAWS		
500	3/8	AA-3	7.50			
500	3/8	AA-3S	8.00			
300	1/4	TA-1	6.00	"QUIK-TRIK" DETACHABLE CABLE END		
500	3/8	TA-3	7.75			
300	1/4	A-W	6.60	"FEATHERLIGHT" MODELS	LIGHTWEIGHT ALLOY WITH REPLACEABLE COPPER ALLOY JAWS	
400	5/16	A-5S	7.75			
200	5/32	JH-2	5.50	"STREAMLINED" MODELS		
300	1/4	JH-3	6.60			
300	1/4	BT-3	6.00	BLADE-TYPE MODELS	STEEL BLADES INEXPENSIVE TO REPLACE	
500	3/8	BT-5	7.50			
300	1/4	B-1	3.25	ECONOMY MODELS	COPPER ALLOY	SEMI-INSULATED
500	3/8	B-3	4.00			
200	3/16	B-4	3.65		MALLORY 3 METAL	

* *All Prices Lower in Quantities*



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We present them all . . . Jackson's complete line . . . light weight—heavy weight—200 amp to 500—tong and blade type. Take time to check this table against the various conditions of work in your shop . . . the light jobs—the heavy . . . the continuous as well as the occasional. Perhaps it will help you to get better, more economical results.

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HOBART BROTHERS CO., Box U-81, TROY, OHIO

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Remember this—no welder is better than the engineering and material that goes into it. Skimped, high speed welders cost you more in the long run—IT'S BETTER TO HAVE BOUGHT A HOBART THAN TO WISH FOR ONE LATER, especially if you are watching costs—need speedier production.

HOBART BROTHERS COMPANY, Box U-81, TROY, OHIO

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Electric arc welding procedure and Practice. A new 544 page text book. Covers every phase of welding.
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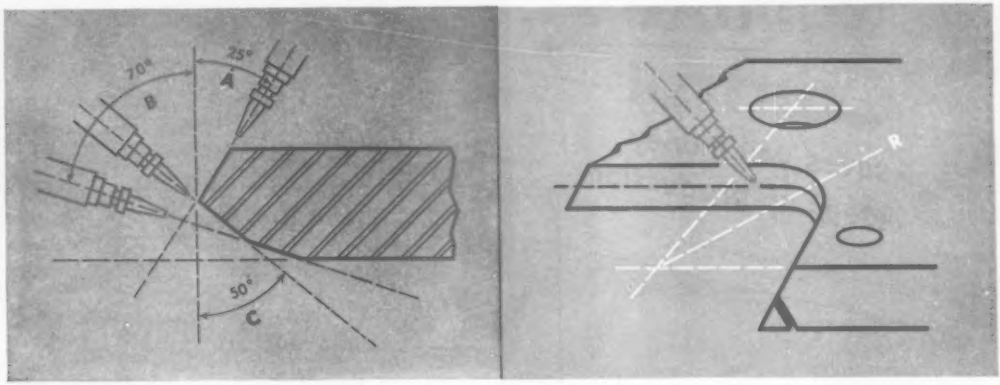
No more grinding edges like these on *armor plate!*

Now—the Acetogen Process allows you to *flame-cut* the most difficult bevels on armor plate to exact *tolerance*—and slash the cost of plate-edge preparation by many dollars per ton.



At last, *precision* flame-cutting of armor plate is a reality! Because of its startling accuracy, versatility, and operating characteristics, the Acetogen Process drastically slashes plate-edge preparation costs!

YOU SAVE MAN HOURS! Intricate bevels and cuts need no longer be slowly ground—they can be quickly flame-cut to ±1/16" tolerance.

YOU SAVE CAPITAL INVESTMENT! You don't need large, expensive grinding machines, or elaborate paraphernalia. The Acetogen Process utilizes standard, readily-available, low-cost equipment and tools.

YOU SAVE TRAINING TIME! Experienced flame-cutters become qualified Acetogen operators within a few days. Novices learn quicker, too, because Acetogen gas is docile, easy to use, dependable.

YOU SAVE FLOOR SPACE! You don't need a whole department devoted to grinding. The *complete* job is done in your Acetogen-cutting department.

YOU SAVE HANDLING COSTS! No need to move heavy plates from cutter to grinder; Acetogen does the job in *one* department, and with little moving of plates.

The most convincing proof of these statements comes from some of the nation's top companies—Henry Disston & Sons, Inc.; Baldwin-Lima-Hamilton Corporation; Fitzgibbons Boiler Co., Inc. These companies have continually been amazed at the speed, precision, *and economy* of the Acetogen Process.

Why not put Acetogen to work cutting *your* armor plate? We will act either as consultants, or as sub-contractors doing the entire job in your plant. *We invite your inquiry.* Acetogen Fabricators, Inc., 822 Commercial Trust Bldg., Philadelphia 2, Pa.

YOU GET THESE SPECIAL BENEFITS ONLY WITH THE ACETOGEN PROCESS

- Armor plate of all thicknesses flame-cut to ±1/16" tolerance!
- Acetogen-cut plates are ready for welding without costly grinding, finishing, bridging, or beading!
- Single- and multi-bevels are as easy to flame-cut as square-edges!
- Acetogen-cut plates have "feather" edges... surfaces have sufficiently low Brinell to allow machining.

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THE WELDING ENGINEER

A McGRAW-HILL PUBLICATION

VOLUME 36 NUMBER 8

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AUGUST, 1951

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Here's why you should

GET IN THE SCRAP

★

Production of the new steel you'll need tomorrow depends on the iron and steel scrap that goes back to the steel mills today. For more than 90 per cent of all U. S. steel is made in open-hearth furnaces from a mixture of pig iron and scrap. To keep going takes over *50 million tons* of scrap a year!

By using iron and steel scrap in this way, steelmakers can produce more new steel—*and do it more quickly*—with existing facilities. Quality of the steel is improved, too.

And raw materials—it takes almost four tons to make one of pig iron—are conserved. Every ton of scrap returned to the mills saves a ton of pig iron, *plus the time to make it.*

Steel mills themselves can furnish only two-thirds of the scrap they need. The rest must come from you. Your idle scrap keeps steel in short supply, hampers the National Defense effort, and costs you money. So sell it, ship it—keep it moving.

Here's what you can do to help get much-needed scrap to Steel Mills

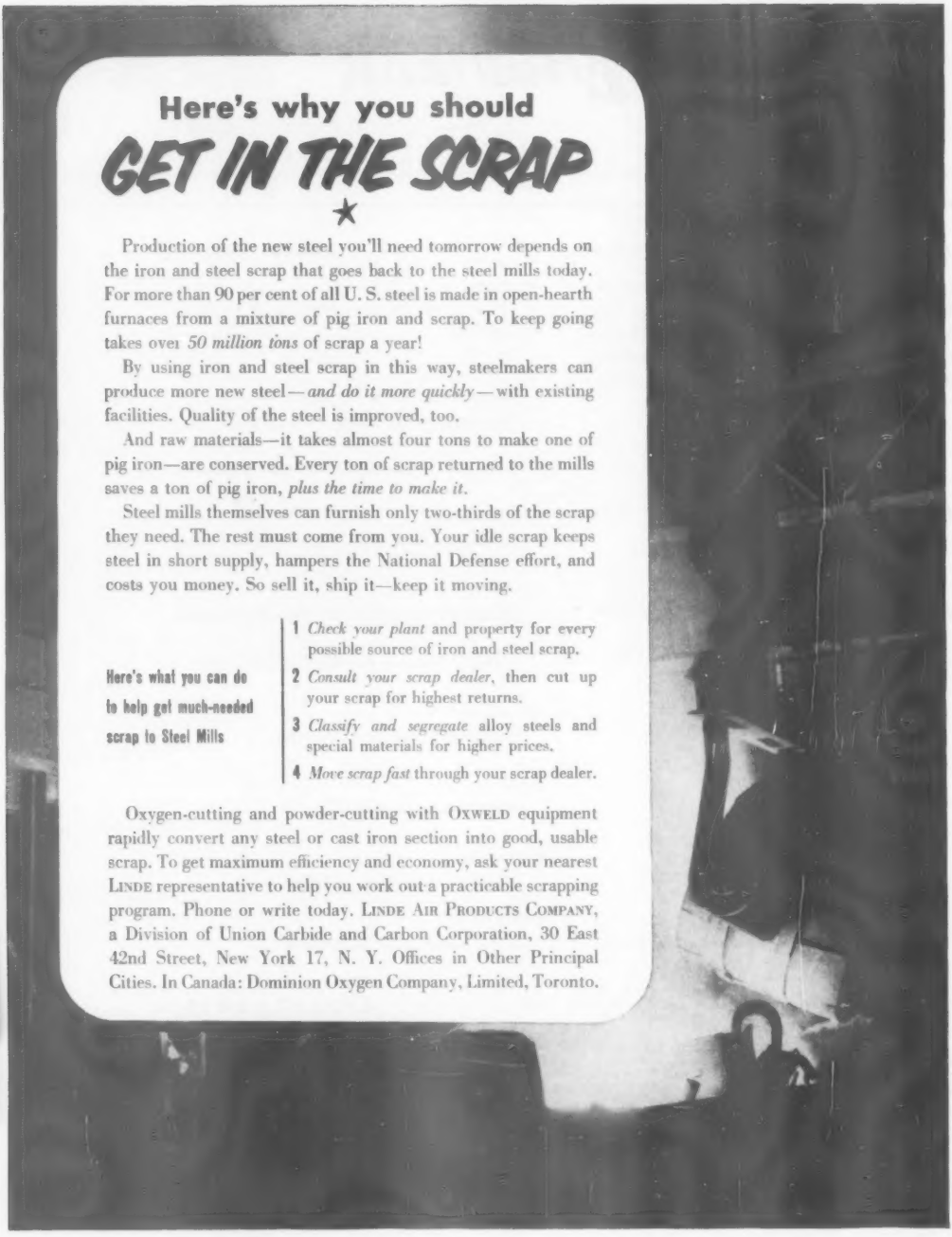
1 *Check your plant* and property for every possible source of iron and steel scrap.

2 *Consult your scrap dealer*, then cut up your scrap for highest returns.

3 *Classify and segregate* alloy steels and special materials for higher prices.

4 *Move scrap fast* through your scrap dealer.

Oxygen-cutting and powder-cutting with OXWELD equipment rapidly convert any steel or cast iron section into good, usable scrap. To get maximum efficiency and economy, ask your nearest LINDE representative to help you work out a practicable scrapping program. Phone or write today. LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in Other Principal Cities. In Canada: Dominion Oxygen Company, Limited, Toronto.



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NEWS FROM WASHINGTON

MRO Authorized by New CMP Regulation 5

MAINTENANCE, repair and operating supplies were brought under the Controlled Materials Plan on July 6th, when NPA Regulation 4 was revoked and simultaneously replaced by CMP Regulation 5.

CMP Regulation 5, now in force, is very much like NPA Regulation 4. Instead of using the DO-97 rating, however, Regulation 5 authorizes use of the allotment symbol "MRO" for the procurement of steel, copper or aluminum products. In addition, it provides the rating DO-MRO on delivery orders for materials to be used with the controlled materials.

The new regulation is self-allocating, in that no application to NPA is required. One difference from NPA Regulation 4 is that manufacturers of "A" and "B" products will not use the MRO or DO-MRO symbols for needed materials; instead, they will have to get them under CMP Regulation 1 procedures.

CMP Reg. 7 Assures Repair Shop Materials

PARTS and materials needed for operation by repair shops will be taken care of under the Controlled Materials Plan by CMP Regulation 7, issued on July 6th.

It won't be necessary to apply to NPA for a controlled materials allotment. Regulation 7 provides a procedure whereby the repair shops set up their own allotments, using allotment Symbol RE. However, a repairman doing work for others is limited in the amount of controlled materials he may acquire under the regulation to (a) the amounts to which his customers' MRO allotment symbols may be extended, and/or (b) the amounts he actually needs in doing work for customers who are not entitled to establish MRO quotas under CMP Regulation 5 or other NPA Regulations, or orders which set up MRO quotas.

In case (b), using the allotment symbol RE, the repair shop is limited to the following amounts in any one calendar quarter: 20 tons of carbon steel, alloy steel and stainless steel (including not more than 3 tons of alloy and one ton of stainless); 500 pounds of copper and copper-base alloy products; and 500 pounds of aluminum.

For complete details, send for Release NPA-960 and CMP Regulation 7 to the Department of Commerce, Washington, D. C., or any field office.

Paperwork Delay Means Slow Start for CMP

RESTRICTIONS that go with the Controlled Materials Plan started on July 1, but its benefits will probably not be felt before September. That's just about the meaning of the DPA announcement that mills producing controlled materials need not accept CMP allotments until September 1. This affects controlled materials in basic shapes and forms. However, the finished products, as stocked by distributors and industrial supply houses, won't appear under CMP until the fourth quarter of the year, because NPA could not get its allotments out early enough to compensate for mill requirements on lead time.

"80 Questions and Answers on the CMP"

HERE's what businessmen have been asking CMP officials at meetings in 20 key cities throughout the country. Maybe you have been asking them, too. The answers are grouped under eight headings, as follows: General; Inventory and Inventory Adjustment; Authorized Production Schedules and Allotments; Allotment Numbers and DO Ratings; Forms and Applications; Repair and Replacement Parts; Warehouses and Distributors; and Maintenance, Repair and Operating Supplies.

Free copies are available from the Distribution Section, Division of Printing Services, Department of Commerce, Washington, D. C., and from Department of Commerce field offices.

Steel Mills Operate on 2-Day Scrap Supply

SOME steel mills are working with the risky margin of two days' scrap supply and many others have less than two weeks' supply in sight, NPA reports. Industry is urged to participate in a national scrap-recovery program.

This ticklish situation is a result of the booming need for scrap as we try to increase steel production. Some 36,000,000 tons are needed for 1951.

Committees have been set up all over the country to encourage all industries, business firms and government agencies to look over old or worn out equipment that might be useful as scrap.

Revised CMP "B" List: Everyone Must File

ALL manufacturers of mass-production items must apply for allotments of controlled materials for use during the fourth quarter of this year if their products contain steel, copper or aluminum. This includes automobiles, household appliances and other durable goods not previously programmed.

At the same time, NPA revised its "Official CMP Class B Product List" of about 4000 products, in which consumer durable goods had been designated by asterisks. Manufacturers of these were instructed not to file for allotments for the third quarter.

On the revised list, these products are no longer so marked, and manufacturers whose products are listed must apply to NPA for controlled materials allotments for the fourth quarter, in order to be able to carry out production schedules authorized by NPA.

NEWS FROM WASHINGTON *(Continued from page 5)*

Amended Pricing Order Helps Tool Makers

OPS HAS amended its Machinery Pricing Order (CPR-30) to help machine tool makers. These manufacturers will hereafter be allowed to use their overtime, premium shift and subcontracting costs in figuring their price ceilings.

When originally issued back in May, the regulation limited the use of overtime and subcontracting costs to the amount used in the base period, and manufacturers had to absorb the difference if these costs went up.

As it has turned out, the volume of premium shift work and subcontracting is quite large. The Munitions Board and NPA had asked heavy equipment makers to follow these practices, if necessary, to increase production. So manufacturers were faced with this choice: either refuse defense-connected orders, or absorb costs and consequently reduce profits.

So . . . OPS has settled the problem by allowing overtime and subcontracting costs to be reflected in their ceiling prices.

Business Inquiry Centers Function Close to Home

THE Washington office of the Commerce Department's Business Inquiry Center has been deluged with some 29,000 personal calls and 23,000 telephone inquiries since its establishment, May 1st. While the Washington office is pleased to be helping, it points out that equally efficient and cooperative inquiry centers are available closer to home. Those who need help or information should seek it, insofar as possible, in one of the 105 Department of Commerce field offices.

Businessmen and manufacturers can get quick answers to their problems in production control in one of the three following cooperative units of the field offices:

1. *Business Inquiry* Unit, which gives out information on NPA and DPA regulations;

2. *Distribution Unit*, where copies of all NPA and DPA press releases, orders, regulations and directives, as well as free copies of various NPA and DPA publications are available;

3. *Reception Unit*, where callers first come, find answers to simple questions, get directed to various government agencies, and are referred to the appropriate unit for the solution of their problems.

If you don't know the location of your Department of Commerce field office, write for the complete list to the Commerce Department in Washington, D. C.

Allotment Numbers, Symbols List for CMP

ALL Government claimant agencies have been instructed by NPA to use the new allotment numbers and symbols, and DO symbols listed in detail in their release on June 22. Also included in the list are the claimant agency programs to which they apply as well as the industry divisions concerned.

These new numbers and symbols have been assigned by the Defense Production Administration in authorizing production and construction schedules, and in making allotments of steel, copper and aluminum under the Controlled Materials Plan. Copies of this useful list can be had by writing to the Department of Commerce, Washington, D. C., for NPA Release 388.

NPA "List of Basic Materials, Alternates"

APPROXIMATELY 550 basic materials have been classified and listed according to their present availability in a new four-page pamphlet. This list is planned as a guide for procurement for the armed forces, government agencies and private business, for both the procurement and possible substitution of materials.

The classifications are used to cover (a) materials in very short supply, (b) materials in tight supply, and (c) those in fair supply.

Up to five copies of the "List of Basic Materials and Alternates" will be provided free of charge at any district or regional office of the Department of Commerce.

Some Additions to Your Defense Alphabet

GOR—General Overriding Regulation.

ACM—Authorized Controlled Materials.

ACMO—Authorized Controlled Materials Order.

GSA—General Services Administration.

GWR—General Wage Regulation.

DR—Distribution Regulation.

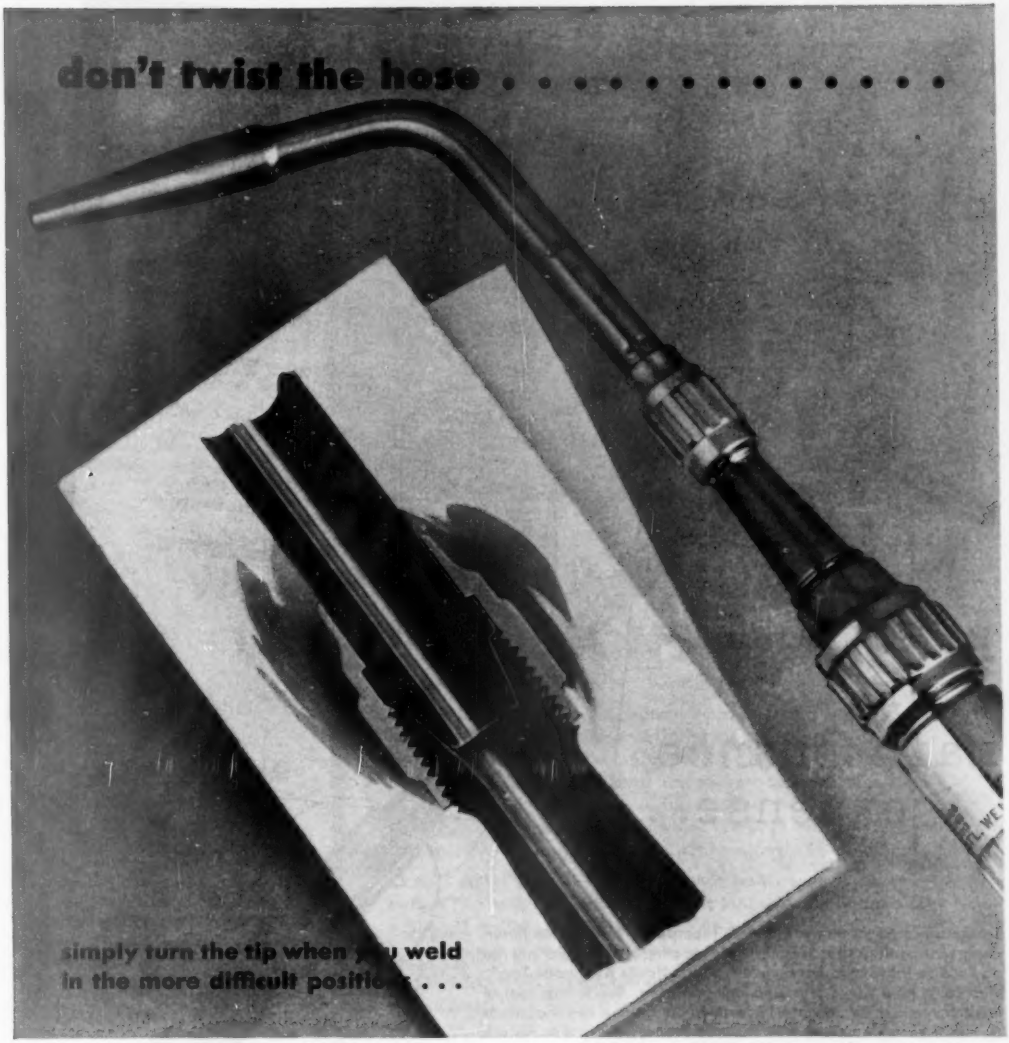
SR—Supplementary Regulation.

IB—Interpretive Bulletin.

DO-97's on Order Still Good in Third

DON'T worry about the MRO supplies you have had on order. NPA officials say that DO-97 orders for maintenance, repair and operating supplies placed before July 6th, under NPA Regulation 4, for delivery in the third quarter, will still be treated on an equal basis with authorized controlled materials (ACM) or DO-rated orders bearing an allotment number or symbol.

As we noted elsewhere in greater detail, the previous MRO regulation, NPA Regulation 4, was revoked and superseded July 6th by the present CMP Regulation 5.



Just touch the work and you can turn the tip to meet your needs when you weld overhead or in awkward positions. You need no longer work under the handicap of turning the torch and twisting the hose.

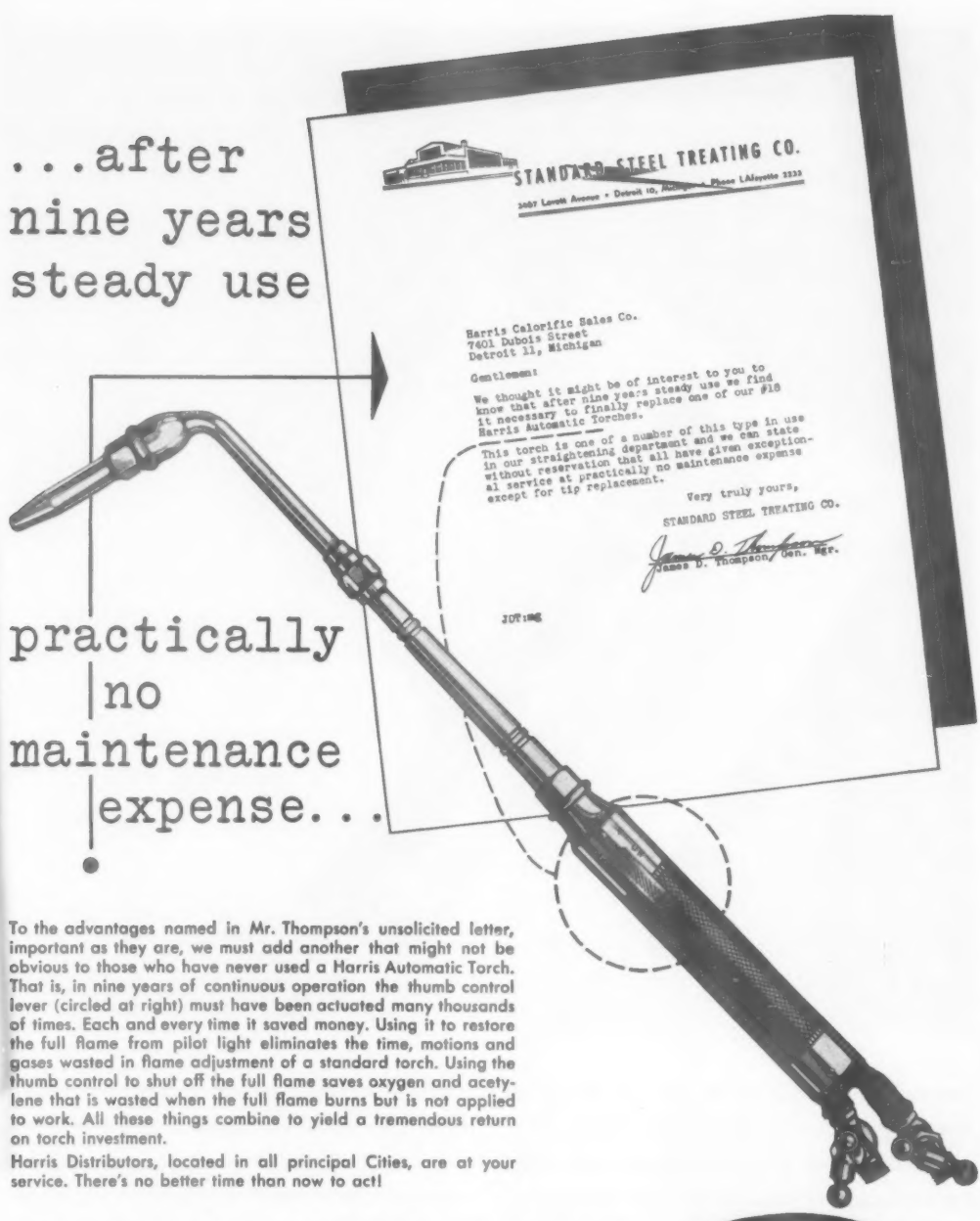
This joint is so designed that you can rotate the tip indefinitely without damaging any component part. Just fingertip tightened creates a permanent leak proof joint. Before you buy your next torch, test for yourself the many advantages NATIONAL can offer you.

Made by National SINCE 1919 WELDING EQUIPMENT CO., San Francisco 5, California

B10

...after
nine years
steady use

practically
no
maintenance
expense...


STANDARD STEEL TREATING CO.
Harris Calorific Sales Co.
7401 Dubois Street
Detroit 11, Michigan
Gentlemen:
We thought it might be of interest to you to know that after nine years steady use we find it necessary to finally replace one of our #18 Harris Automatic Torches.
This torch is one of a number of this type in use in our straightening department and we can state without reservation that all have given exceptional service at practically no maintenance expense except for tip replacement.
Very truly yours,
STANDARD STEEL TREATING CO.
James D. Thompson, Gen. Mgr.

To the advantages named in Mr. Thompson's unsolicited letter, important as they are, we must add another that might not be obvious to those who have never used a Harris Automatic Torch. That is, in nine years of continuous operation the thumb control lever (circled at right) must have been actuated many thousands of times. Each and every time it saved money. Using it to restore the full flame from pilot light eliminates the time, motions and gases wasted in flame adjustment of a standard torch. Using the thumb control to shut off the full flame saves oxygen and acetylene that is wasted when the full flame burns but is not applied to work. All these things combine to yield a tremendous return on torch investment.

Harris Distributors, located in all principal Cities, are at your service. There's no better time than now to act!

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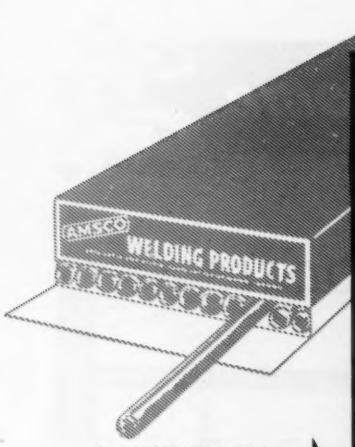
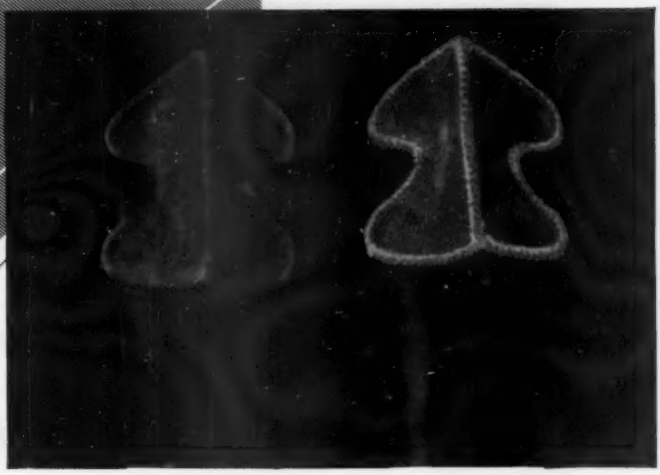
SERVING THE METAL INDUSTRY SINCE 1905



How AMSCOATING with Amsco Hardfacing Rods saves you materials . . . manpower . . . money.



Why will ONE of these bits LAST TWICE AS LONG?

AMSCOATING...stands for control of wear by Hardfacing...

Hardfacing rods—and recommendations for their use—are as sound as the manufacturer who makes them. AMSCO has been fighting wear for a half-century—first with Manganese Steel, and later with AMSCO Hardfacing Products.

If you have a problem of wear caused by impact, abrasion, heat or corrosion . . .

Find out how AMSCOATING can save you materials . . . manpower . . . money!

These bits are used by a Southern quarry for drilling blast holes. A combination of limestone and flint causes extreme abrasion—and a real problem of wear. In an attempt to cut replacement costs, labor and down-time, several makes of hardfacing rods were tried, but without much success.

Six years ago these bits were AMSCOATED with an Amsco® rod specially developed for combatting abrasion and impact.

Result? AMSCOATING did a job that had never been done before. The drill bits held their edges longer . . . averaged 60 hours of drilling—between regrinds—instead of 30. Maintenance costs and bit changes were cut in half!

AMSCOATING saves you money in terms of lower maintenance costs, less down-time . . . more production. *The actual on-the-job example cited above is one of the many applications that prove it!* Write today for illustrated catalog describing dollar-saving AMSCO rods . . . and the name of your nearest AMSCO distributor.

AMSCOATING
THE RIGHT WAY TO SAY HARDFACING

Brake Shoe **AMERICAN MANGANESE STEEL DIVISION**
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Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
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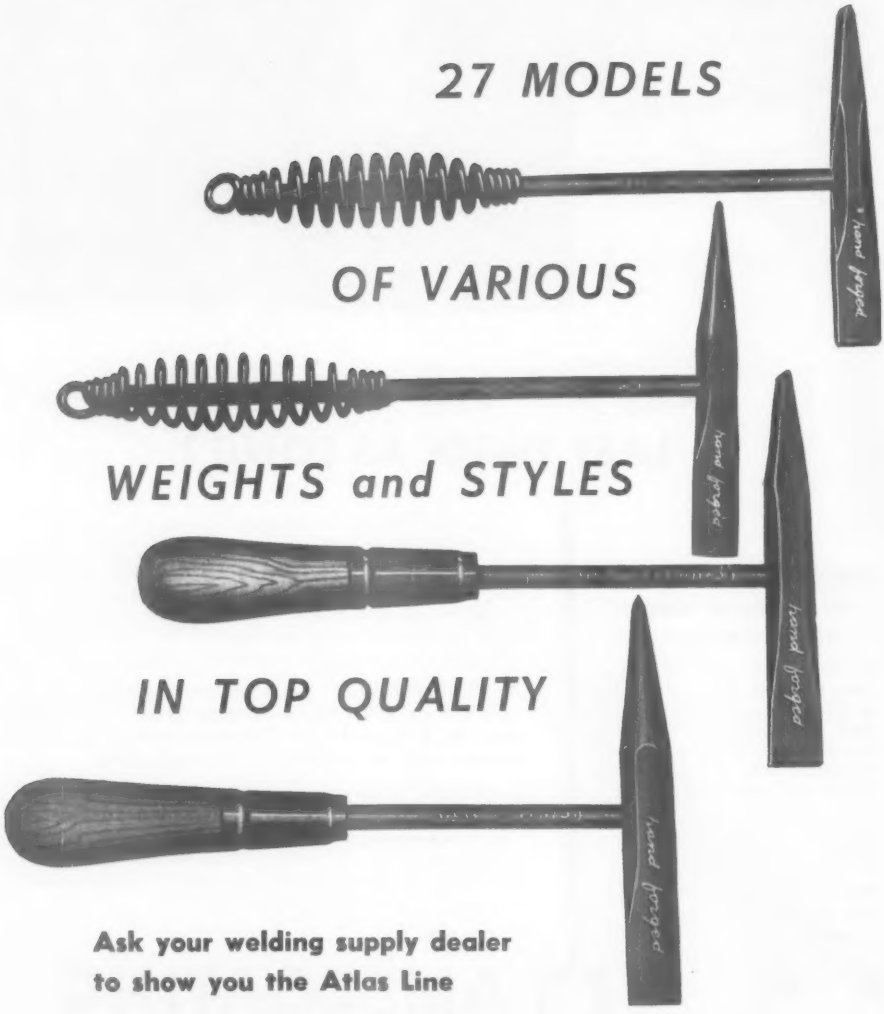
Tough as they come

27 MODELS

OF VARIOUS

WEIGHTS and STYLES

IN TOP QUALITY



Ask your welding supply dealer to show you the Atlas Line

Atlas WELDING ACCESSORIES CO.

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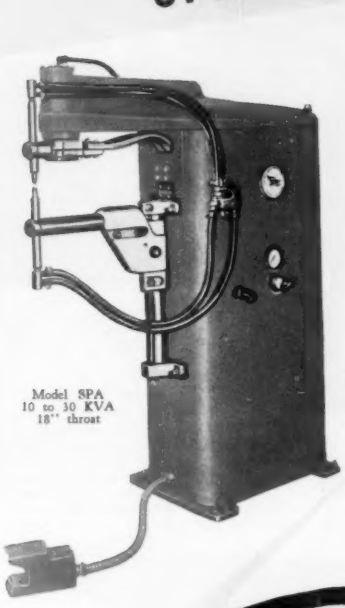
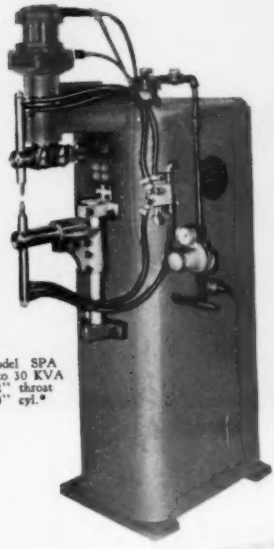
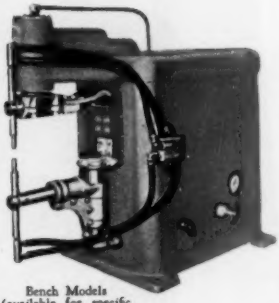


Model SPA
10 to 30 KVA
18" throat



Model SPA
10 to 30 KVA
12" throat
4" cyl.*



Bench Models
(available for specific requirements for bench mounting.)

MODEL SPA SERIES
10-15-20 and 30 KVA

Banner SPOT WELDERS

A BANNER Welder does your job faster — and better. Its special design and construction features raise plant production and efficiency.

ONLY BANNER OFFERS ALL THESE FEATURES . . .

★ BANNER Welders can continuously and accurately weld up to *225 spots a minute.*

★ Time tested proof of a Banner development is the unique design of ram and cylinder and the *long bearing surface of 7".*

★ Up to 7" adjustment on lower knee.

★ Heavily ribbed cast iron head, with integrally cast cylinder *provides utmost rigidity.*
Manganese Bronze piston specially equipped with 3 cast iron double seal (automotive type) rings. *Reduces friction* up to 50% thus permitting necessary follow up *after* welding cycle.

★ Pin and alot arrangement *prevents piston from turning.*

★ Piston actuated by foot switch and *solenoid operated air valve.*

★ Heavy duty selector (with contacting pads of ample cross section) provide *8 stages of heat regulation.*

★ All current carrying members are designed for *over load capacity* and made of high conductivity copper alloy.

★ Secondary and secondary pads are *water-cooled* assuring dissipation of heat in the horns and laminated shunt.

★ Frame is ¼" *boiler plate.*

Specific data sheets and catalog available. Write today!

Banner manufactures a complete line of Gun, Seam, Rocker Arm and larger Press Welders and Specials to 200 KVA. Inquiries invited.

*For special application with double acting cylinder and hand valve (for tip dressing). Also available in 30" throat.

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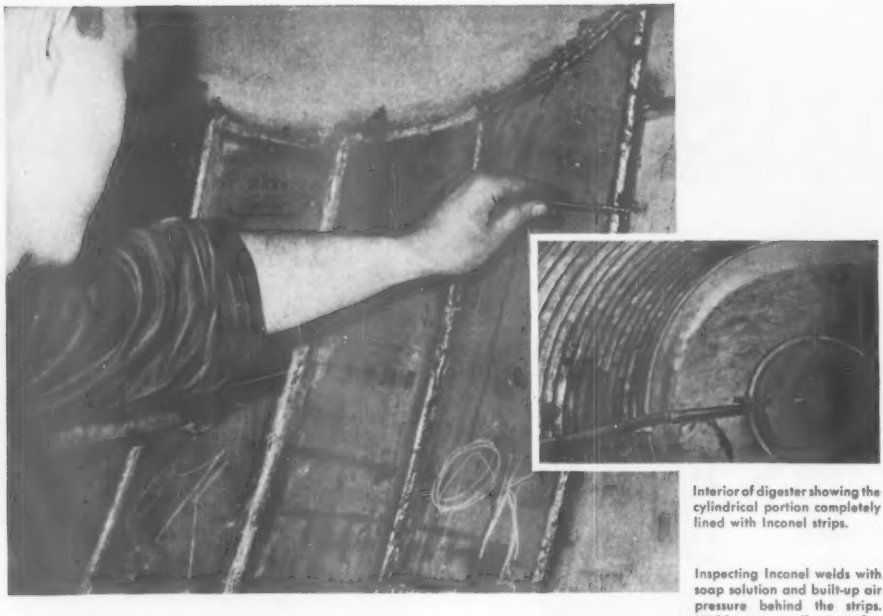


Interior of digester showing the cylindrical portion completely lined with Inconel strips.

Inspecting Inconel welds with soap solution and built-up air pressure behind the strips. Welds are actually circumferential but appear vertical because digester rests on its side. Thilmany Pulp & Paper Co., Kaukauna, Wisc.

An experiment to save $12,000

. . . and its success depends on WELDING

Thilmany Pulp and Paper Company were faced with the expensive prospect of replacing a carbon steel digester at a cost of over $24,000. But before scrapping it, Thilmany decided, as an experiment, to line the digester in their plant.

The lining material had to be highly corrosion-resistant and it had to have a coefficient of expansion close to that of the carbon steel.

After much investigation, they determined that Inconel would give the corrosion resistance they needed. And the coefficient of expansion was sufficiently close to that of the carbon steel for expanding and contracting during the cooking cycle. *Therefore, the determining factor between success and failure was the welding job.*

Here's how they did it.

First they washed, sandblasted, chipped and arc-welded cracks or depressions on the inside wall. Then ⅛" thick, six inch wide strips of cold-rolled, annealed Inconel® were pressed out circumferentially against the walls by means of a hydraulic jack.

While a strip was held in place, two welders worked from the top down and laid two continuous fillet welds. After the strip was welded completely around, the slag was chipped and welds were tested for leaks. When found to be sound, a third bead was laid between the fillet welds of the plates. The plates were staggered in four and five foot lengths, approximately ⅝" apart.

Inconel "132" welding electrode was used for the job. Its deposits are corrosion-resistant. And its ductility, and coefficient of expansion are approximately equal to those of the Inconel strip.

Thilmany estimated that it would cost $12,000 to do the job as compared to over $24,000 for a new digester. *This amounts to over $12,000 savings made possible by the proper materials and efficient welding.*

The story of Thilmany's experiment and a complete description of the welding process is yours for the asking. Write for "Corrosion and Field Lining of Sulphate Digesters."

INCO

The International Nickel Company, Inc.

67 Wall Street, New York 5, N. Y.

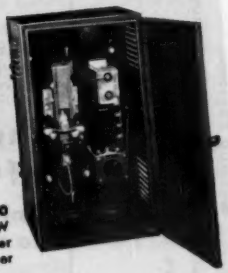
LYON Metal Products selects SQUARE D WELDER CONTROL

There's a lot of "beneath-the-surface" quality in Lyon Kitchen Cabinets . . . and spot welding plays a major part in their sturdy construction and beautiful appearance. For consistent quality and continuous production, Lyon specifies Square D resistance welder control.

Simple ***Safront*** timer construction, using dependable pneumatic timing relays, assures easy inspection and maintenance. ***SYNCRO-BREAK*** contactors are especially suited for use with production welders which must operate over a wide range of weld times and duty cycles. Synchronized opening of the contact tips eliminates arcing and permits higher current ratings.

Square D also offers electronic contactors and timers for jobs requiring unusually short and precise timing, high welding currents, or high speeds.

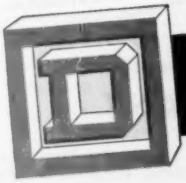
Class 8991
Type TCS-10 NEMA 5B
Safront Sequence Weld Timer



Class 8990
Type SCG-2 Size 2W
Syncro-Break Welder Contactor

NEMA 3B and 5B Timers and Sizes 1W and 2W Contactors have same dimensions

Write **for Class 8990 Bulletin 211 and Class 8991 Bulletin 210, Square D Company, 4041 N. Richards Street, Milwaukee 12, Wisconsin**



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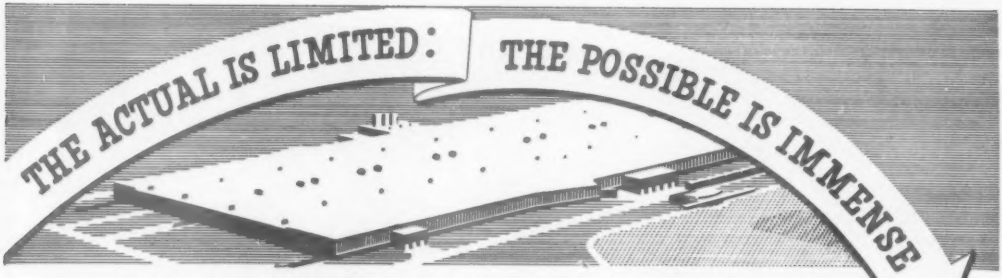
SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S. A., MEXICO CITY, D.F.



NEW LINCOLN PLANT CREATED BY INCENTIVE-INSPIRED CO-RETION IN DEVELOPING POSSIBILITIES IN PRODUCT
© LE Co. 1951

HOW ECONOMIES OF WELDED STEEL CUT YOUR PRODUCTION COSTS

WHEN designs utilize the economies of welded steel construction, invariably costs are less. That's because fewer pounds of less costly material are needed . . . Each pound of metal can be more easily concentrated where it does the most good.

Wherever costs are higher, inevitably the designs have fallen short of embodying the potential savings, or the products themselves have been overdesigned. A careful reappraisal by the shop before a design is "frozen" simplifies construction details and eliminates every unnecessary expense for lowest cost of manufacture.

Your Lincoln Welding Engineer will gladly help you analyze your designs and point out various cost reduction possibilities. Simply call or write.

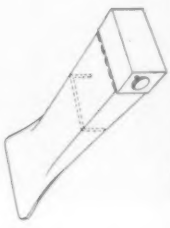


Fig. 3. Saves 51% Cost *by forming lever arm and pad as integral piece from 10 gauge metal. Weighs 2.5 pounds . . . costs 54¢.*

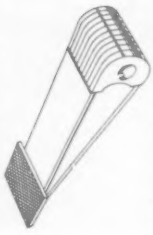


Fig. 4. Saves 67%. Eliminates Broaching. *Hub with integral key is produced by stacking stampings in assembly. Arm is 10 gauge, brake formed and welded to hub. Cost is only 31¢ . . . weight 2.2 pounds.*

the ACTUAL

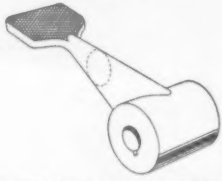


Fig. 1. Traditional Construction. *Machine foot-lever, 10 inches long, weighs 6 pounds. Cost with broached keyway is $1.15.*

increasing the YIELD

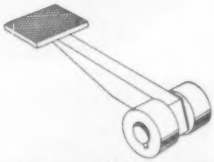


Fig. 2. Simple Steel Design Costs 34% Less. *Can be built by the shop with only saw and shears. Weighs 2.7 pounds . . . costs 68¢ complete with keyway.*

the IMMENSITY of the POSSIBLE

Unlimited opportunities to create efficient, lower cost designs.

SEE HOW STEEL BUILDS IT WITH LESS MATERIAL

Machine Design Sheets are available to designers and engineers. Simply write on your letterhead to Dept. 78.

THE LINCOLN ELECTRIC COMPANY

CLEVELAND 1, OHIO

ESTABLISHED 1914 THE WELDING ENGINEER AUGUST, 1951

Be Sure It's Scrap

THE RAPID EXPANSION of our steel industry necessitated by the war and defense program has brought in its wake enormous demands for iron and steel scrap. It takes a lot of scrap to make steel—every ton of steel turned out by an open-hearth furnace requires just about as much scrap as it does new iron from the blast furnace.

This year it will be necessary to feed 32,500,000 tons of scrap to the open-hearth furnaces in order to meet our country's steel needs. That amount of scrap is three million tons more than was consumed last year. If our defense program continues through next year, as is most likely, still another three million additional tons of scrap will be needed. It all adds up to an amazing total, and it's going to require some organized and highly concentrated effort to find it and bring it in.

To date, no steel mill has been shut down because of inadequate scrap inventories. Unless these inventories are expanded, however, some steel mills may find themselves in serious difficulties by next winter.

To users of welding and flame-cutting, the campaign to provide adequate scrap for steel production is somewhat confusing. Those who use welding intelligently have already learned how to make good use of what others term "scrap." For them it's not scrap at all but good, usable material.

These modern fabricators may be hard put to meet their quotas in the various scrap drives. Naturally, they won't want to hamstring the defense effort by hindering steel production, but should they scrap something they may be able to use in their own businesses? The answer, as it has been all along, is to scrap intelligently.

Obviously, a shop should not be cluttered up with unusable odds and ends, hoarded as a jackdaw hoards bright pebbles in the vague hope that they may be needed sometime. Apart from the scrap urgency, the senseless hoarding of metal takes up valuable storage space and presents a safety hazard. If you aren't going to use it, get rid of it. That's a darn good rule to follow.

To look at the other side of the picture for a minute, however, it's an equally poor policy to discard material that may be utilized in production. That includes small pieces of plate, bar stock, pipe and tubing for which you know you will find a use, and it also includes much broken machinery.

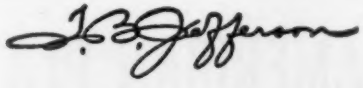
If you have made intelligent use of maintenance welding over the years, you know what can be done in the repair and reclamation of worn machinery and equipment.

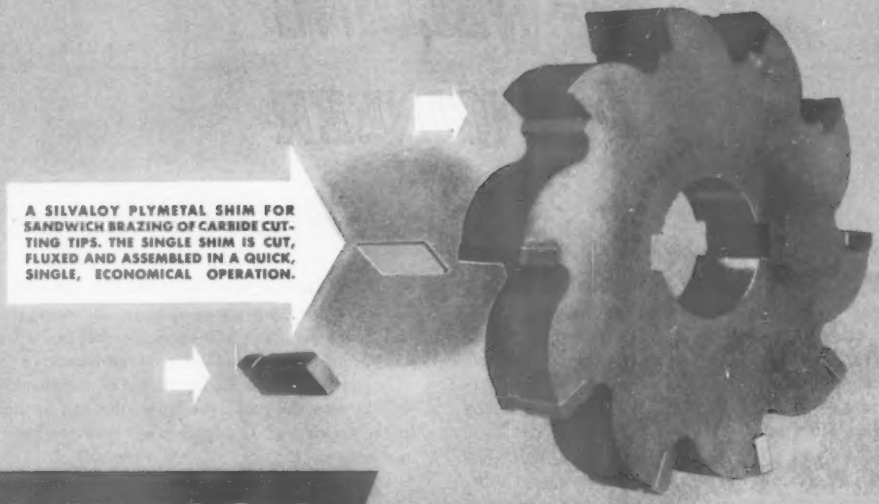
Just because a machine has broken down from old age, doesn't necessarily mean that it is beyond hope. Often it can be repaired by a mere welding job to render equal or better service than it gave in its youth. Under the circumstances, you'd be a fool not to repair it by welding. If you scrap it, a much larger amount of vital cast iron or steel will have to be utilized to make a replacement. There is absolutely no point to such kind of scrapping.

We are probably talking to the converted when we address the readers of this page. But those who are not so well acquainted with the possibilities of welding and flame-cutting may be overlooking many a good bet by scrapping things that could be repaired. They will probably contribute to scrap campaigns many items that will have to be replaced. And the net gain to our economy will be minus.

Scrap it, if it's scrap! But if it is a part, machine or any unit in your plant that will have to be replaced, then repair it by welding. The whole idea of scrap collection is to obtain material for additional steel, not to create a new demand for steel to use in making replacements for articles contributed in a fervid but misguided patriotism. When welding will reclaim a needed item, don't scrap it. Its scrap value will be extremely small compared with the loss that our production effort will suffer through the diversion of new materials to replace the scrapped item.

Let's get all the scrap we can into the scrap heap and on to the open-hearth furnaces. But let's be sure that it *is* scrap.



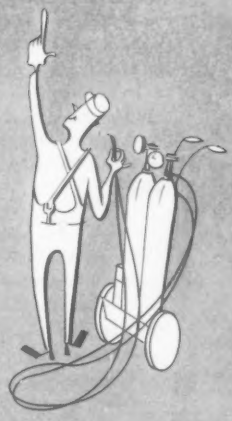

A SILVALOY PLYMETAL SHIM FOR SANDWICH BRAZING OF CARBIDE CUTTING TIPS. THE SINGLE SHIM IS CUT, FLUXED AND ASSEMBLED IN A QUICK, SINGLE, ECONOMICAL OPERATION.

SILVALOY plymetal preforms cut brazing costs more than 40%!

Preformed #5031 Silvaloy Plymetal shims helped this manufacturer to double production in brazing carbide tips on this cutter . . . for a 40% *saving in labor costs!* With better results than ever before!

Also, it was necessary formerly to clean the cutters by sandblast and to remove excess solder with rubber wheels. The present method, using induction heating and #5031 Silvaloy Preformed Plymetal has eliminated the need for clean-up procedures and enabled the manufacturer to cut the quantity of brazing material required by approximately 35%.

A Silvaloy technical expert may be able to help you cut costs, speed production and improve brazing results in your plant. Call or write today. This useful service is offered without charge or obligation. We'll be glad to have you take advantage of it. ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★



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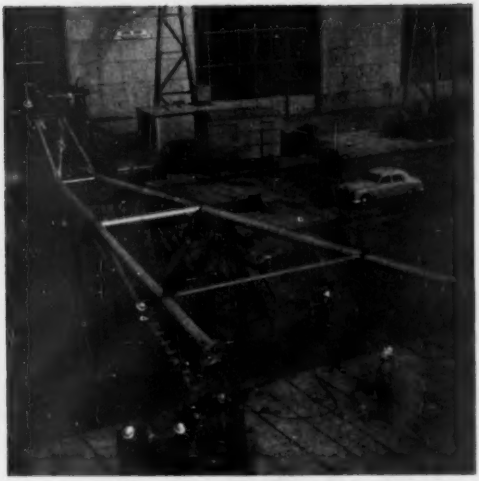
JOINING BRACING to main 20-in.-diameter leg of the tripod mast. The other two legs are of 10¾-in. tubing



WITH WELDING completed, the aluminum tripod mast is ready to be carried to destroyer at Naval shipyard

Aluminum Masts for Radar

High antennas to give a larger radius of radar detection are one of today's needs. The Navy is offsetting the greater weight by substituting aluminum for steel.

AN ENEMY squadron slips through dawn skies, gunning for a Navy carrier task force. Thousands of feet below, pips suddenly dance on the radar scope of a patroling destroyer. Seconds later the whole task force is alerted. Battleships and cruisers deploy swiftly into preplanned defensive patterns. Fighter planes catapult from aircraft carrier decks, climb fast to intercept the enemy flight.

Thus radar transforms what would have been a stunning surprise attack on sitting ducks into an ambush—with the Navy ready and waiting to lower the boom. To throw up such an effective detection screen, far-ranging patrol craft must carry an increasingly greater weight of radar antenna high atop their masts. The Navy has adopted the idea of substituting lighter aluminum all-welded tripod masts for the heavy single steel sticks formerly used. This change-over is currently being effected on "Radar Picket" destroyers.

Construction and installation of the new type-masts at the San Francisco Naval Shipyard made exacting work for all hands. For the main tripod leg, ten-ft lengths of ⅜ in. aluminum (the standard 61 ST6 alloy) plate were rolled into 20-in. tubing and longitudinally welded. Next the tubes were butt welded together to make up the mast's 38-ft height. Twenty-foot lengths of ¼-in. drawn aluminum tubing (10¾ inches in diameter) were butt welded to make the two smaller legs of the tripod mast. In all welding on the masts, weldors utilized the inert-gas (helium) process.

Two courses of horizontal bracing made the mast self-supporting. This was some trick. Not only must the mast support a huge equipment load, it also has to withstand (without the aid of guy wires) the terrific side stresses brought on by the destroyer's rolling and pitching at sea.

Next step was to attach the two radar antenna platforms as a unit to the tripod. Finally, wire and other accessory housings were added; yard painters gave the structure the traditional coat of Navy gray, and the mast was ready to be transported through the bustling shipyard by giant cranes and then barges to the destroyer.

SHIPYARD WORKER readies base of main mast leg for installation

At the waiting destroyer, the 38-ft main leg was set on and bolted to the stub of the steel mast. The small legs spread-eagle the ship's forward stack and rest on ½-in. deck reinforcing inserts. With its tripod legs and two antenna platforms, the aluminum mast towers more than 60 ft above the destroyer's main (weather) deck. From first rolling through fabrication to installation, the job took about eight weeks.

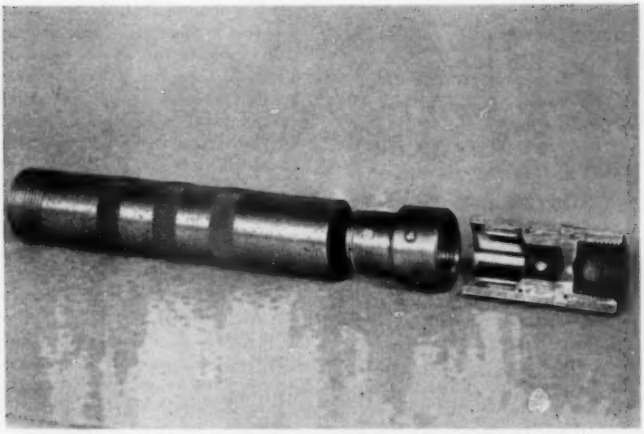
Photos courtesy of Kaiser Aluminum and Chemical Sales, Inc.

Photo from Lucas-Milhaupt Engineering Co.

1—STRESS-RELIEVED RINGS, made to fit job specifications, increased production from 60 to 480 units an hour

Induction Brazing—
Short Cut to Greater Output

2—BRAZING threaded fittings to refrigerator compressor housings



3—THREADED HEAD is to be induction brazed into cylinder of hydraulic jack to straighten auto frames. The cutaway at right shows the joint

Steel below the Curie point (1,420 F) can be heated about 100 times as fast by induction heat as with a furnace having a wall temperature of 2,000 F.

BY JOHN A. EVANS

*Kenworth Metal Stamping Co., Milwaukee**

PRODUCTION economy and product quality are two good reasons for a change in product design or method of manufacture. In particular, parts made from standard bar stock, stampings, pipe, extruded sections, etc., can be substituted for more expensive castings or machined parts. Thus it's often possible to effect economies in production and to improve a product by changing its design and/or production method.

In many instances, such a change requires a brazing operation. Induction brazing, because of its adaptability to many different applications, is becoming increasingly popular in plant modernization plans.

"Brazing" or "hard soldering" commonly refers to a bonding process using alloys that flow at temperatures above 800 F and below the melting point of the parent metal. "Soft soldering" alloys flow at temperatures usually below 800 F. Alloys falling in the classification of low-temperature brazing melt in the range of 800 to 1,500 F, whereas high-temperature alloys melt between 1,500 to 1,800 F. Most common brazing alloys are in the low-temperature range and have a silver base. For this reason, the process is called silver brazing.

* At the time this article was prepared, Mr. Evans was with the electronics section of Allis-Chalmers Mfg. Co., Milwaukee, to whom we are indebted for the photographs.

Extra Operations Eliminated

A typical example of efficient and economical application of induction brazing and its advantages over conventional methods is illustrated in Fig. 3. The piece shown is part of a hydraulic jack used in straightening automobile and truck frames. The job is to braze a threaded head into a hydraulic cylinder.

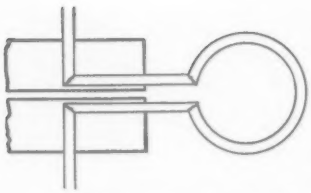
The inside surface of the cylinder is honed up to the brazed joint, and brazing rings are inserted into the two circular slots located on the plug. After the brazing rings are placed, fluxed and the parts assembled, the assembly is put within the work coil. Using a 20-kw electronic induction heater, a heat cycle of about 30 seconds produces excellent results. The bond is such as to leave a slight fillet around the cylinder without causing any discoloration of the honed surface more than ⅛ to 1/16 in. away from the brazed joint. The amount of discoloration allowed was about ⅜ in.

Originally, the assembly was arc welded manually. The best production rate was 30 pieces per hour, with about 25% rejects due to leaks. The leaks were caused by the confined area of weld and the inability of the weldor to puddle the metal properly. Another objectionable feature of the old method was that each assembly had to be refinished prior to shipping. Induction brazing produces about 65 pieces per hour with rejects due to poor bond almost completely eliminated. In addition, the previously needed machining operation has been completely eliminated.

The stress-relieved silver-brazing rings were designed and made for this particular job. The work coil consists of three turns that surround the 1½-in. cylinder slightly beyond the area between the two brazing rings.

How to Make a Brazing Coil

Every brazing application requires a different coil to fit the size or shape of the workpiece. This is far from being an obstacle since three out of four coils are relatively simple to construct and can easily be made by the user. To make most coils, you will only need a torch, brazing material, a hack saw and, of course, either square or round copper tubing. Additional equipment is sometimes required for the more elaborate coils. Since most work coils are water



4—SIMPLE one- turn coil may be easily made from copper tubing. In order to get shape exact, corners should be mitered and brazed shut

cooled, they are made of copper tubing.

First, cut and bend the tubing into the desired shape and size. To get a more exact shape to the coil, the corners should be mitered. This is done by cutting a notch so that when the notch is bent closed it will give the desired angle to the tubing. The notch is then brazed to seal the opening. Coils can also be made without mitered joints, by simple bending, but the results are not as good. The coil is brazed to two bus bars, which are bolted to the induction heater. The coil shown in Fig. 4 is relatively simple. If more than one turn is required, be sure that the turns do not touch each other. Nor can any part of the coil touch the work.

The two threaded fittings in Fig. 2 are brazed onto each refrigerator compressor housing. The work coil in this case is beneath the housing with a single turn extending up into the housing. This particular arrangement makes it easier to assemble the parts and place them on the work fixture. During the 35-second heat cycle (plus the time it takes for the braze to set), the operator is able to prepare additional housings with flux and brazing material so that assembly-line production can be maintained. This method of operation gives the induction heater a rather high load factor for this type of work.

Brazing Materials Vary

Induction brazing, if applicable, is in itself a great aid in increasing both quality and quantity production. Additional benefits in output, quality and economy can be obtained, however, by a careful consideration of related factors. For instance, brazing materials.

The characteristics of alloys employed for brazing vary widely, depending upon individual composition. So great is this variety that an alloy is available to suit almost every application. There are, however, a number of points that must be considered.

Prices vary considerably, depending, usually, upon the silver content of the alloy. High-temperature alloys having little or no silver are generally cheaper, but a larger power output or a longer heat cycle is required to obtain the higher temperatures. Some alloys will not bond to certain metals at all or will bond only when careful preparations are made. The "flow" or capillary action of alloys varies along with their strengths. All these characteristics must be considered in determining the particular alloy to use for a particular job.

In some cases, the choice of alloy is more or less limited by the type of metal to be bonded. "Phos-Copper," for example, will adhere to copper very well without a flux but requires fluxing if used to join brass, iron and metals. Silver solder, though it always requires fluxing, seems to work well on almost all metals. Silver alloys flow better; "Phos-Copper" is easier to use in covering an open joint or crack such as a mitered angle in copper tubing. Silver solder can be used on Monel or nickel, but the area must be free of any stress such as is found in products fabricated by deep drawing. With any and all alloys, the best results can be obtained when the surfaces are clean.

Obviously, the duration of the heat cycle used with a low-temperature alloy will be less than that for a high-temperature alloy. How much less, however, will depend to a considerable extent upon the particular application and type of metal.

In order to gain some idea as to the amount of energy transfer, we conducted a rough test using a 20-kw electronic induction heater. A five-turn coil 2 in. long and with 1½ in. ID was made of $\frac{5}{16}$-in. square copper tubing. We used it to braze copper and steel samples, each $1\frac{5}{16}$ in. long by $\frac{15}{16}$ in. in diameter. Here's what we found:

Steel pieces heated for 15 seconds to a surface temperature of about 2,000 F received 100 Btu. Steel pieces heated for two seconds attained a surface temperature of about 1,500 F with only 36 Btu. The time ratio is 7½ to 1. The steel pieces heated for 15 seconds, however, did not receive 7½ times the amount of heat of those heated for two seconds but less than three times the amount of heat. This is because magnetic characteristics of steel disappear above the Curie point (1,420 F). Induction heating, therefore, becomes much less efficient above that temperature.

When a copper piece was heated for 15 seconds it received about 14.5 Btu; heated for two seconds it received about 1.8 Btu. In this case, the heat-content ratio is about the same as the time ratio. The copper piece heated for 15 seconds received eight times (close to 7.5) the Btu of the piece heated for two seconds. The reason why copper behaves differently from steel in this respect is that copper is non-magnetic even at low temperatures. It is noteworthy that steel below the Curie point (in this instance the 2-second heating) received 20 times the Btu that copper received in the same time.

These basic comparisons of test results provide a rough estimate on the savings that can be made by using a low-temperature alloy. It must be remembered, however, that such alloys are the more expensive. Better run sample tests to determine the advantages of each alloy before you make the final selection.

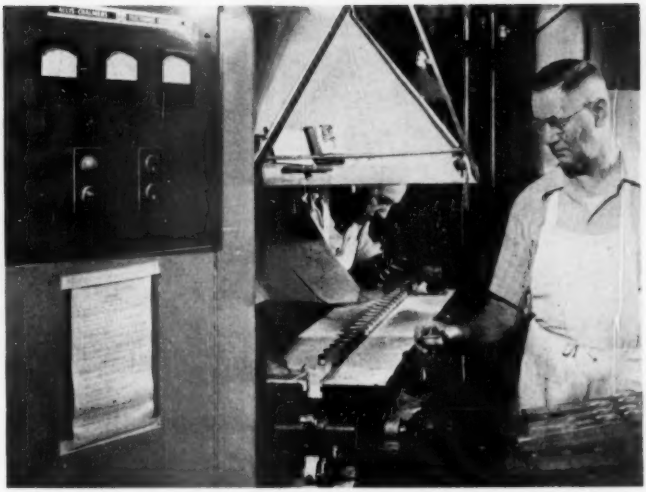
Job-Designed Preforms

Development of stress-relieved silver-brazing rings in notched coils has been another factor greatly contributing to better production, quality and economy. These are designed for specific jobs and can best be done when the design of the work accommodates a ring or preform. A beveled edge or groove will contain the brazing material properly and assist in directing its flow. The use of shoulders, standard keying methods, etc., can be of advantage in preparing and aligning pieces.

Where the joint is irregular, brazing material is usually applied by hand in wire form. The advantage of using preformed shapes is that each joint gets a predetermined and uniform amount of material. Less material, fewer rejects, improved joints, increased production and the elimination of machining operations are the benefits derived from using preforms. Moreover, the operator is free during the brazing operation to prepare additional pieces.

Machine-wound preforms may distort during brazing heat and fall away from the joint. This is caused by the stresses that are built up during forming. Stress-relieved rings, made to specification, retain close tolerance without distortion during heating. The coil of rings is notched so that a ring can be removed easily without breaking or distorting it. The rings shown in Fig. 1 are used for silver brazing of noxious-gas strainers for household refrigerators. The specially made rings raised production from 60 to 480 strainers per hour and reduced cost from $3.00 to $0.67 per hour—800% production increase and a 77% cut in cost!

Other benefits included a reduction in the percentage of rejects—from 10% to 0.5%—the elimination of postbrazing machining and a 25% saving in silver alloy. Considerable saving in handling and assembling also resulted.



5—CONVEYORS are often used to carry the parts to the brazing coils

Fluxing and Flux Removal

The surfaces to be brazed should be thoroughly cleaned and free of dirt, oil, grease, etc. Lack of clean surfaces causes failures due to irregular flow, complete misses and porosity. Porosity is caused by gases, caused in turn by impurities beneath the flux; with rapid heating, the gas bubbles may remain in the alloy as it cools. In most cases a coating of flux is sufficient for cleaning, but some applications will require additional treatment such as sanding, scraping or hot alkaline or acid baths.

After brazing, it is often necessary to remove the flux, usually with hot water. If scale or oxide is to be removed, an acid pickle bath is generally necessary. Little oxide is found on parts that have been induction silver brazed, and the flux generally washes off in plain water.

The size and shape of the brazed joint will depend upon the application. Design the joint to give the best appearance, greatest strength and maximum ease of brazing. Joint design for silver brazing is influenced to a great extent by the unusual flowing qualities of the alloy. Because of capillary action, the liquid alloy penetrates very quickly into narrow openings.

Drive fits leave little room for brazing alloys (except for fillets) and thus do not produce strong joints. Excessive clearances will result in joints with strength below the maximum. A clearance between 0.001 and 0.004 in. provides joints of the greatest tensile strength.

Surfaces for butt joints should be cut square and even to provide close and uniform clearances. Scarf joints assure greater joining surfaces without increasing the wall thickness. Lap joints are most satisfactory because of greater bonding area, better resistance to corrosion (due to less exposed brazing alloy), control of tolerances and good capillary action. Strong fillets are possible.

Methods of Handling

Induction brazing generally is most efficient when applied to: (1) high production of (2) uniformly symmetrical pieces having (3) a relatively limited mass to be heated. Conveyors are often used, as in Fig. 5. A conveyor method of passing the material through the work coil is generally faster, results in greater production and in more uniform handling operations with less motion. Against these advantages must be weighed the greater cost of handling equipment. Manual placement of the pieces results in less production and more handling, but the fixture cost is lower and in many cases a better job is done.

Better results are obtained with the one-piece method of brazing as contrasted with the batch method. The work coil can be placed more advantageously to the joint, bringing the heat where it's needed instead of depending upon the conduction of heat to the joint.

Induction heating is an economical and practical method of heating steel. Steel below the Curie point (1,420 F) can be heated about 100 times as fast by induction heat as with a furnace of wall temperature at 2,000 F. Induction heat can in many cases be accurately controlled as to location, duration and intensity. It is thus suitable for a wide range of applications. With proper work-handling equipment, the induction method is readily adaptable to the production line.

These features of induction heating reduce the maximum temperature required for brazing, reduce oxidation and warpage, reduce heating time, heat the entire brazed joint simultaneously. Improved products result in fewer rejects. No long heat-up periods are required and there is no fuel wasted during idle periods. A change in work coil and handling equipment enables the same power source to be used for heating, soldering, case hardening, annealing, etc.

Despite its many advantages, induction heating is not the solution to all metal-heating problems. It does, however, offer good possibilities and should be considered for practical reasons when changes are to be made in product design and manufacturing.

1—MANUAL flame-cutting: hole is for 14-in. outlet on a 36-in. OD pipe with ¾-in. wall. Circle was outlined by centerpunch marks

2—MACHINE flame-cutting: again hole is for 14-in. outlet on 36-in. OD pipe

Flame Processes Assist

Oxyacetylene processes applied to pipe fabrication are flame-cutting, flame-gouging and flame-heating. Benefits are versatility, flexibility, low initial cost.

BY EDGAR P. AULER
Superintendent of Pipe Fabrication, Taylor Forge & Pipe Works, Chicago

GAS TRANSMISSION lines carry pressures as high as 1,000 psi in pipe as large as 34 in. in diameter. Steam power plants use piping systems at 1,500 psi and 1,050 F. Oil-refining equipment has miles of piping operating at even higher pressures and temperatures and also, at the other extreme, at temperatures as low as —325 F. The manufacture of pipe and the assembly of pipe and fittings for such installations would not be possible without the aid of the various oxyacetylene processes.

Three basic oxyacetylene processes are employed in the manufacture of pipe and in pipe fabrication. The tools needed are:

(1) The oxyacetylene cutting torch.

(2) The oxyacetylene gouging torch.

(3) The oxyacetylene flame of a heating torch.

The oxyacetylene cutting torch provides a convenient and readily portable means for the cutting and shaping of steel at a low cost. Essentially, the cutting of ferrous materials is merely the direction of a jet of pure oxygen into an area that has been previously heated to the ignition or kindling temperature, about 1,600 F. As the iron is oxidized, the jet is slowly and uniformly moved along the line to be cut. If the cutting is to be continuous, however, it is necessary to supply heat to the metal just ahead of the oxygen stream. This required heat is called "preheat."

Oxyacetylene gouging is a rapid and economical method of forming U-shaped grooves by removing surface or edge metal. In pipe fabrication, the gouging operations can be classified into the three following groups:

(a) Progressive gouging of the undersides of arc welds.

(b) Spot gouging of temporary tack welds and the removal of defective weld metal.

(c) The forming of a welding groove suitable for high-quality arc welds prior to any welding operation.

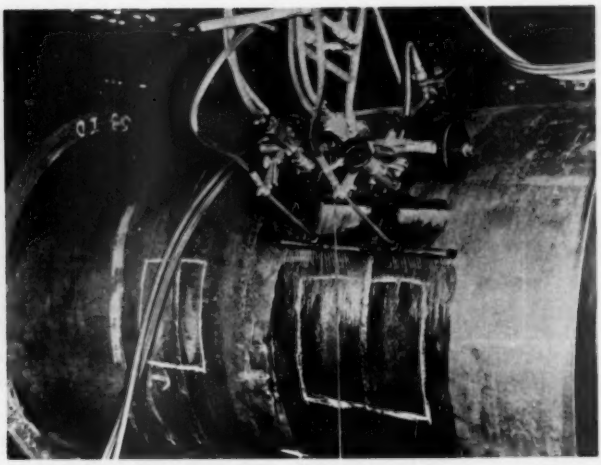
For gouging, we employ a special tip that delivers a relatively large volume of oxygen at low velocity. This jet, when coupled with proper preheat flame distribution, cuts a smooth and accurately defined groove in steel.

In our third category, heating, the combustion of oxygen and acetylene in about equal volumes produces a flame far hotter than any other known gas flame. The temperature of the oxyacetylene flame is estimated to be about 6,000 F. Thus it is a convenient source of localized heat for a wide variety of such operations as forming and bending, straightening, preheating and postheating for welding, etc.

THREE SOURCES FOR GASES

We can't overemphasize the importance of an adequate source of and distribution system for oxygen and acetylene gases. Whether we are initially setting up oxyacetylene equipment or expanding existing equipment, future requirements must be considered for overall plant economy. In some cases the initial investment is quite high, and good planning is necessary to realize a maximum return on the investment.

3—FLAME-GOUGING: groove is formed on underside of a weld in chrome-moly



4—FLAME-HEATING: this application is low-temperature stress relieving of weld. Pipe is 53 in. in diameter with 7/16 in. wall

Pipe Fabrication*

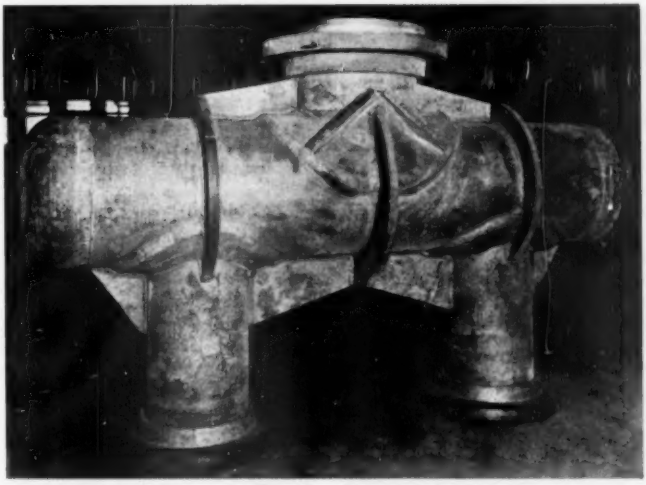
It's well to know the three methods available to supply and distribute gases and how they can be used in various combinations to give the best overall economy.

The first and simplest oxyacetylene unit consists of the familiar cylinders of oxygen and acetylene, both with regulators, mounted on a cylinder truck or "buggy" for mobility and ease of handling.

When higher rates of gas flow are required, an arrangement of cylinders called manifolding should be employed. There are two such systems: portable manifolding with the unit at the work site and stationary manifolding with the manifold supplying a piping system. When the cylinders are manifolded, one group is used as a supply while the other group is being replaced. In this way a continuous gas flow is assured.

A possible variation is to use manifolded oxygen cylinders with acetylene generated from calcium carbide in acetylene generators. These generators are available in both stationary or portable units, in sizes capable of producing from 12 cu ft per hr to 6,000 cu ft per hr of gas.

Manifolding provides a continuous gas flow and is very economical in initial cost unless long pipe runs are required. A system of manifolding is probably the one best suited to the average fabricating plant.



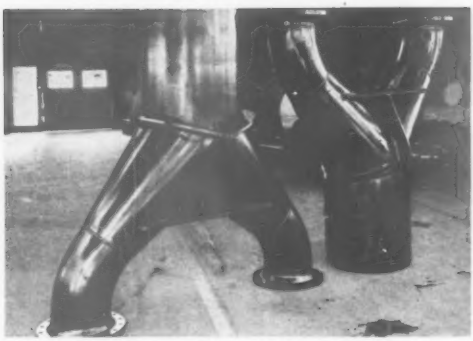
5—FABRICATED 22-in. header for river crossing on gas transmission pipe line was made by welding pipe sections to flame-cut pads and gussets

Piping Distribution

The third and most adequate source and distribution of gases involves a piping distribution system throughout the entire fabricating plant. This involves a large initial cost but results in economical gas consumption cost and is suitable for the larger fabricating shops.

With a piping distribution system, the oxygen source is either long tubes

* Abstract of a paper presented at the International Acetylene Association 51st annual convention, Montreal, May 21, 1951.



6—Y-FITTING is 30 by 16 by 16 in., with 9/16 in. and ½ in. wall thicknesses. Note taper in the legs

7—BASKET STRAINER: interior contains a screen mounted on skids made by surface brazing skid angles

of high-pressure oxygen (which are permanently mounted at the fabricating plant or on truck trailers) or a liquid oxygen storage holder. Both of the above sources are permanently connected to the piping distribution system through a suitable regulator.

Acetylene is supplied to the pipe system from relatively large acetylene generators. Sufficient standby equipment is provided to allow for the recharging of spent generators.

The piping system must be designed to handle and distribute the gases without undue pressure drop and to deliver the volumes required at the various work sites throughout the fabricating shop. Both acetylene and oxygen lines are usually parallel.

Connections to the piping system at the point of use are made by suitably designed equipment. The oxygen line is generally fitted with a filter, a shut-off valve, hydraulic back-pressure valve, relief valve, a vent pipe to the outdoors and/or a regulator. Back-pressure valves are strongly recommended for all acetylene piping systems.

Cutting Operations

In considering the general applications of the oxyacetylene processes to pipe fabrication, let us first investigate the preparation of material for fabricating. Probably the most common use is the preparation of pipe ends for welding. Because of the need for speed and precision, it is highly desirable to machine cut the ends. This may be rather simply done by mounting a torch on a stand, and revolving the work at a uniform rate. The torch is set at the proper angle to produce a smooth welding bevel, suitable for any code welding with a minimum of cleaning after cutting.

A variation of this method is a device that clamps to the pipe and allows the torch to revolve around the pipe at a uniform rate. This alternate beveling method is most often used on pipe of small diameter.

Both manual and machine cutting torches are used in the preparation of outlets on main piping. Figure 1 illustrates the manual cutting of a 14-in. outlet on a 36-in. pipe of ¾-in. wall thickness. With manual cutting, the outline must be centerpunched to give the fabricator a guide he can follow. The finished cut will require some grinding to prepare the section for welding. We cut outlets manually in cases where there are few to be cut and the set-up time for machine cutting would not warrant its use.

Figure 2 illustrates the machine cutting technique used on outlet holes. A radius rod is used and the torch is set at the proper angle to produce the desired welding groove. Cleaning is cut to the minimum, and the outlet can be readily fitted to the hole, which is a true circle cut to the proper diameter.

Machine cutting has definite advantages in header work, where a number of outlets are fabricated on a given length of pipe. Equipment has been developed and is in use in fabricating shops which can accurately cut the holes in the main run and also cut the nozzle pipe sections to fit the main run contour. These machines are an excellent example of the versatility of the oxyacetylene cutting process.

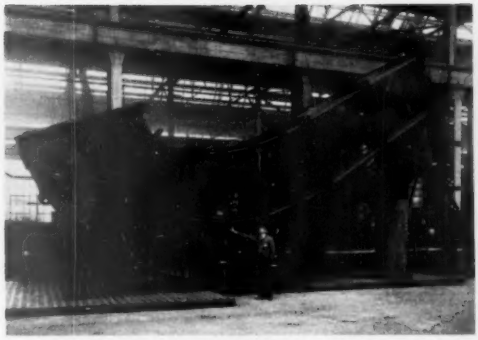
Basically, such machines operate by rotating the pipe while a cam or gear drive, interconnected with the pipe rotation, drives the torch. The motion of the torch may be adjusted to cut either the hole or the nozzle contour. These machines are generally limited to a maximum diameter of 24 in. They can produce square or bevel cuts for straight, curved or angle work on almost any intersection required.

The manufacture of large-diameter pipe often requires the joining of plates by automatic welding. We advocate the double butt weld, which requires an edge preparation of a double bevel with an included land. This preparation can be most economically effected with oxyacetylene equipment. All three of the required cuts are made simultaneously.

After edge preparation, the plates are ready for automatic welding with only a slag chipping operation. In this process, the use of nozzle blocks and premixed gases for preheat again illustrates the versatility of oxyacetylene cutting. In our particular set-up, both welding edges of the plate are cut and the ends trimmed at the same time, thus completing the plate preparation in one operation. A total of eight cutting nozzles are in use at one time under the control of one operator and a helper.

Gouging Operations

Gouging equipment has been accepted by most shops as an excellent tool to provide better pipe fabrication. At present the majority of gouging is done manually, although we have converted this equipment to machine gouging in a few cases with a great deal of success. A typical manual operation is shown in Fig. 3. In this in-



8—SYPHON INLET for water supply system. It has both a rectangular (left) and a trapezoidal section

9—LEAD CONDENSER was fabricated by joining sections of corrugated furnace pipe to fabricated elbows

stance, the operator is forming a welding groove on the underside of a weld. He cuts the groove down to the sound metal of the inside weld. The material being gouged is a 4-6% chrome-moly steel. No difficulty was encountered.

Besides the preparation of welding grooves, gouging is also done to remove defects in welds. The big advantage of the process is that the operator has full control of the depth of the groove. At the same time, he can see when he has reached the sound metal because of the difference in color while the area is molten. Compare this with grinding or chipping, where the metal is smeared over during the operation.

In the fabrication of large-diameter piping, a majority of the welding bevels are manually torch cut because they are of the job-shop variety and do not lend themselves to the more costly machine cutting set-ups. We have found it a good idea to flame-cut the pipe lengths straight, tack weld them together and then flame-gouge to produce the final bevel. This combination of methods results in a welding bevel most suitable for code welding. The operator follows the square butt joint with his gouging torch and forms a groove to the desired depth for the pipe thickness. After this groove has been welded, the underside is again gouged to sound metal, as previously discussed.

Uses of the Heating Torch

One of the principal uses of the heating torch is the preheating of materials prior to cutting and welding. To meet the constant increase in the operating pressures and temperatures required for piping, alloy steels have been introduced to provide pipe structures having the necessary physical and metallurgical properties.

Some of the low-alloy steels in thinner sections can be welded the same as mild steel. Heavier sections, restrained joints and steels of higher alloy content require preheating prior to any cutting or welding. The 1951 edition of the Code for Pressure Piping (ASA B31.1-1951) lists requirements for the preheating of carbon and carbon-molybdenum steels. However, most fabricators have determined their requirements through experience for the alloy steels that are used in fabricated pipe structures.

When the preheat temperature range is from 100 F to 400 F, the heating torch is played along the welding joint so as to heat the area uniformly without too great a temperature variation. Excessive heat or too rapid a heating are to be avoided. This preheating operation is almost always done manually.

When the preheat temperatures range from 400 F to 900 F, it often becomes necessary to measure the temperature accurately prior to and during any welding or cutting operation. This is done with surface pyrometers or by pellets, liquids or crayons manufactured to melt at the given temperature. The heating torch is used as often as is necessary to bring the temperature to the required point. As an operator gains experience, he is able to judge temperatures quite accurately by the amount of heat radiated from the weldment.

In field applications, the heating torch serves very well as an accurate, economical means of preheating. More and more do field fabricators appreciate this tool as a means of solving tough welding problems by providing preheat.

A certain amount of distortion occurs in the welding of fabricated piping. This is due to the fact that the structures are relatively thin and are not restrained. Even where supports and struts are applied to prevent distortion, it is often necessary to perform a straightening operation. Because of the close tolerances of fabricated piping, this can best be done with a heating torch.

The torch is used to heat rapidly a small band to a plastic temperature. Since the surrounding area is cold, the plastic metal upsets slightly. As the entire section cools, the upset area "pulls," causing a change in the shape of the section. Generally, several small bands are better than a few large ones. In this manner, main run pipe ends can be rounded up when a header has been welded near the end.

The third important use of the oxy-acetylene heating torch is in the heating of sections for forming operations. Areas of about 6 in. in diameter can be heated to approximately 1,700-1,800 F. The area is then deformed by a hand forming operation to fit the required contour.

Special Applications

The high chromium and chromium-nickel alloys can be successfully torch cut by use of special equipment to blow in a powder or fluxing material to remove the oxides of the alloying elements. It is these oxides that pre-

(Continued on page 56)

1—TRACK ROLLER frame assembly on a "Caterpillar" D8 tractor. (A) sprocket; (B) idler wheel; (C) track rollers; (D) track carrier rollers

2—AUTOMATIC welding machine for track rollers and idler wheels

Keeping Tractors

When new track rollers and idler wheels can't be bought, the old ones must be made to last longer. Here is the way they can be reclaimed by automatic hard-facing.

BY CLYDE B. CLASON

IN THE GOOD OLD DAYS of plentiful replacements, worn tractor parts were customarily scrapped. Today, as the shortage of new parts becomes serious, they are treated with loving care. Track rollers and idler wheels provide very good examples of vital parts that are today in short supply. The rapid wear that occurs on such parts would ordinarily result in their frequent replacement. When new rollers and idlers can't be had, however, the old ones must be reclaimed for longer service.

This is being done by automatic hard-facing at the Peoria Tractor & Equipment Co., of 400 Franklin St., Peoria, Ill. Before we go into details, though, it might be a good idea to take a quick look at a typical tractor.

A Job for Tough Going

The 130-hp* "Caterpillar" Diesel D8 tractor shown in Fig. 1 is used for heavy scraper work, for logging big timber, for bulldozing or for any other sort of job that requires "big power." The good traction that results when the deep grousers dig into the ground enables most of the engine power to be converted into drawbar pull. The two tracks when equipped with standard 22-in.-wide shoes provide a total ground contact area of 4,389 sq in.—almost 30 sq ft of support for soft, muddy going.

The 17½-ton weight of the tractor is distributed evenly over the track shoe area by two rigidly braced track roller frame assemblies. At one end of each track is the drive sprocket (A in Fig. 1); at the other end the idler wheel (B). In between and toward the bottom are six track rollers (C), which are held to the frame by large cap screws. Three of the rollers (the first, third and fifth) are double flanged to keep rollers and track rails in alignment on side hills and rough ground. The alternate rollers (second, fourth and sixth) are single flanged.

The front idler wheel is supported on brackets that slide on hardened guides and are held against the guides by springs. The top counterpart of the track rollers are the two track carrier rollers (D), rigidly mounted on the top of the frame.

The set-up just described is, of course, duplicated on the other side of the tractor. Thus there are altogether twelve track rollers (not including the top carrier rollers) and two idler wheels on a D8 tractor.

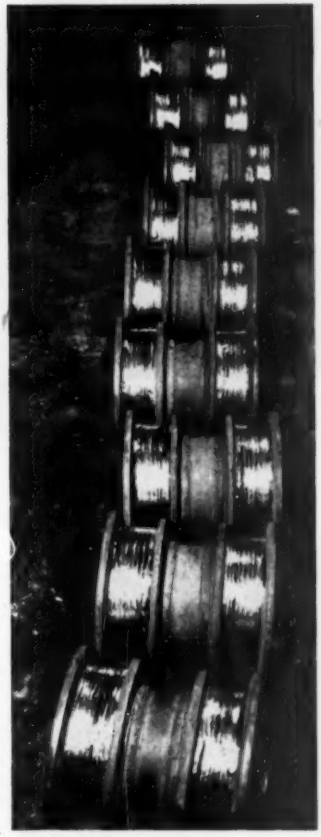
Track roller rims and idler rims are given special heat-treatment during manufacture to obtain the maximum surface hardness. Nevertheless, they are subjected to heavy wear. In the old days this didn't matter too much because replacements were quickly available. Today it's an entirely different story.

How It's Done Today

Peoria Tractor & Equipment Co. has solved the problem of conserving track rollers and idlers by the installation of a submerged-arc welding head and automatic positioning machine. A customer who brings in a complete set of D8 track rollers can have them rebuilt and ready to put back within two days.

* Drawbar horsepower. Maximum belt horsepower is 144 hp.

3—WORN ROLLERS awaiting rebuilding. The 25 by 30 ft shop of Peoria Tractor & Equipment Co. can turn out about six completed rollers per day



4—FIRST PASS has been applied to each of these rollers. They are worked on alternately to allow them to cool between passes and so avoid any distortion from welding heat

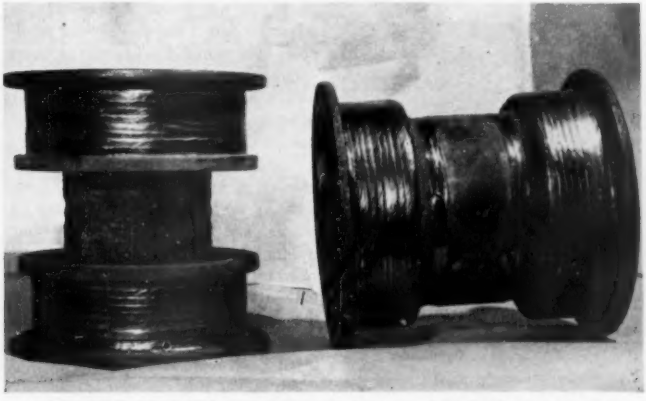
in Service

Fig. 2 shows the simple construction of this equipment. The track rollers are supported by grooved wheels, which are adjustable to fit different models of rollers; the idler wheels are mounted on a shaft for rotation. The welding head is cantilever-mounted on a sleeve, which may be slid up or down a vertical tube in order to obtain the proper height.

Up to 30 in. of bead per minute can easily be deposited by this equipment for automatic hard-facing.

So far, Peoria Tractor & Equipment Co. has facilities to handle only tractor rollers and idler wheels. However, states Service Manager J. R. Loomis, the company hopes eventually to get an automatic machine for hard-facing sprocket wheels; such equipment is now in the design stages but is not yet on the market. A device for automatic hard-facing of track links (another fast wearing part) is likewise undergoing experiments and may soon be available. The top track car-

5—WELDOR Vallie Sims uses the paddle to make a dam for the flux



6—REBUILT ROLLERS require no grinding or other finishing. The roller on the left is double flanged; the one on the right is single flanged

7—J. R. LOOMIS (right) holds template to gage the wear on an idler wheel. Sales Manager Floyd Rusher is the gentleman on the left

8—BEFORE: a badly worn tractor idler. Note the holes in the rim

9—AFTER: holes were filled up with patches before rebuilding rim

rier rollers are of cast iron and cannot be rebuilt by hard-facing at an economical cost.

Wires for Hard-Facing

Hard-facing by submerged-arc was not feasible until about four years ago, when the first hard-facing wires for application through the submerged-arc welding head were placed on the market. One of the early wires was designed specifically for the rebuilding of tractor and shovel parts such as track rollers, idlers, house rollers, arch wheels and the like. Hundreds of tons of this alloy have been applied to tractor parts.

Peoria Tractor & Equipment Co. uses this type of wire for rebuilding tractor rollers because it fuses at a comparatively low amperage and thus helps to avoid heat distortion. The wire is a composite, having an outer casing of mild-steel strip (formed as a continuous tube) that holds such alloying elements as chromium, molybdenum, vanadium, etc. The resulting deposit combines toughness with high wear resistance.

For idler wheels, a different type of wire is used: one that can be applied at a current of 100-125 amp greater than the current for track rollers. This wire is a modification of SAE 6150 chrome-vanadium steel, with enough manganese added to work harden. It deposits at 250 Brinell and can be work hardened up to 375 Brinell.

Both products are excellent for their particular purposes.

Since Peoria Tractor is a "Caterpillar" dealer, it rebuilds only that make of equipment. So far the company has not found it necessary to advertise that it has this service available; the word has gotten around somehow, and scarcely a working day passes without at least one customer bringing in a set of rollers for overhaul.

The majority of the track rollers brought in belong to D8 and D7 tractors. As we have said, the D8 has 12 rollers. The D7 has 10 rollers. Other tractor models are the D6 with 12 rollers, the D4 with 8 rollers and the D2 with 8 rollers. It's easy to see that there will be from four to six times as many rollers as idler wheels to be rebuilt. Each idler wheel, however, is a much bigger job.

With one full-time weldor and one machine, in a shop space 25 by 30 ft, Peoria Tractor & Equipment is able to rebuild six rollers in an average time of eight hours—about 1½ hours per roller. The average idler will take 6 to 8 hours to build up. If wear has been moderate, however, that is if the center flange has not been worn enough to require build-up, the idler can probably be done in about 3½ hours.

Avoiding Heat Distortion

Figure 3 shows the company's "back-log" of worn rollers awaiting repairs, and Fig. 4 a group of rollers that have received their first pass. Rollers are put through as a set rather than individually. Weldor Vallie Sims lays one pass at each end of a roller as in Fig. 5, using a paddle to serve as a side dam for the flux. He then sets the roller on the floor and takes up another for similar treatment. When all members of the set have received their first pass, the second pass is applied to each roller in turn and so on. This method of working allows the hard-faced roller ample time to cool between deposits and avoids the heat warpage that might occur if all of the metal were deposited at once.

Some rollers require as many as five or six passes for rebuilding. The average is probably three to four passes. Badly worn rollers may cost almost as much to rebuild as new ones would cost, but when new rollers are not available such cost comparisons become academic rather than practical. Mr. Loomis estimates that a set of rollers brought in before the wear has become too severe can be rebuilt at a saving of from 40% to 50% of the cost of new rollers. He stresses that tractor owners should examine their rollers and idler wheels more often and not continue them in service until operating failure occurs.

When to Rebuild

The most economical time to build up a roller, asserts Mr. Loomis, is before it has worn to the point where the flanges hit the pin boss of the track link. It can still be reclaimed after that but at a considerably greater expense.

Figure 6 shows a finished pair of rollers of the double-flange (left) and single-flange types.

For track rollers, hard-facing is

done at 300 amp and 30 volts. Travel speed will average 30 inches per minute.

Neither rollers nor idler wheels require grinding or other form of finishing after the hard-facing is applied. All that is necessary is to knock off the slag between passes with a hand hammer. When square corners are built up, the slag has a tendency to cling more tightly and must be chipped off with a pneumatic chisel.

Rebuilding Idler-Wheels

Idler wheels are handled a little differently from track rollers. Since there is no warpage problem, greater current can be used and one wheel can be worked upon until it is finished. The depth of wear at the top and sides of the wheel is measured by a special template gage. The company has prepared one of these for each model of tractor. In Fig. 7, Mr. Loomis is holding the gage to demonstrate how much metal must be replaced along the sides. The gentleman watching him is Floyd Rusher, sales manager of the Peoria Tractor & Equipment Co.

A similar set of gages is being made up for track rollers, which are at present gaged with calipers before and as the hard-facing progresses.

Idler wheels are hard-faced at 400 amp and 32 volts. The wheel is rotated at a speed of one revolution in 3 minutes, which gives a travel speed of 30 inches per minute.

In Fig. 8, we see a badly worn "Cat" D8 tractor idler. The owner has permitted wear to advance to the point at which salvaging costs as much or perhaps even more than a new wheel. When you can't buy a new idler, however, what else can you do but try to fix up the old one? Moreover, the expense will be justified by an increased service life.

The several long holes in the rim were plugged by laying a piece of mild-steel welding rod across each hole and fusing it in place. After all the holes were filled in this manner with weld patches made from the inside, the idler was placed on the automatic welder for several overlays of weld metal. In Fig. 9, we can see that it came out looking as good as new.

Yes, conservation has entered our national picture again, and it's decidedly fortunate that automatic welding has entered the field of repair and reconditioning. Simplified controls and the elimination of costly fixtures have reduced the price of automatic equipment to the point where almost any tractor dealer can afford the investment.

What Customers Dislike

No. 12 in a series of inspirational talks on "Twelve Self-Assignments to Sales Success"

BY RICHARD C. BORDEN

READ the items on the list that follows with a pencil handy. Put a big check mark opposite every item that makes you wince a little . . . because you feel that YOU are being described.

Then, all the rest of this month, concentrate on trying to correct these self-assigned flaws in your selling personality.

Keep trying until you *have* corrected them.

Check List

1. He was too darned nonchalant. His lounging, slouchy manner . . . the way he smoked in my presence . . . without permission.

2. His eyes were shifty and evasive. I didn't like the way he avoided looking me in the face.

3. His eyes were unfocused and dreamy. I didn't like their blank stare.

4. I didn't like the phony way he smiled. When he *tried* to smile, his face changed expression stiffly, making him look like a pained anteater. Or else he masked his face with the uneasy half smile that you sometimes see on the face of a baby about to burp.

5. His whole manner was that of an order hawk rather than that of a fellow sincerely trying to help me. I got the impression that my order meant to him the same thing a scalp used to mean to an Indian.

6. I didn't like the bored, impatient way he listened whenever I talked.

7. I didn't like the liberties he took in my presence . . . placing a soiled hat on my papers . . . balancing a lighted cigarette on the edge of my desk . . . knocking off his cigar ashes into the little glass bowl that held my paper clips.

8. I didn't like the pompous, bombastic way he orated his sales talk. He spoke as if I were a public meeting.

9. I didn't like the pitying look in his eye when I raised an objection. Nor the supercilious arch of his eyebrows, the impatient tap of his fingers nor his snort.

10. I didn't like the inquisitive way his eyes roved over my desk.

11. He fingered his lips as he talked so his words sounded like drinking coffee out of a mustache cup.

12. I didn't like the presumptuous way he breezed into my office and took the initiative in shaking my hand.

13. His general manner implied he thought he was a wiser, better man than I. I didn't like that AT ALL!

14. His nervous mannerisms distracted my attention as he talked.

15. He impressed me as the kind of fellow out to cultivate your friendship for strictly selfish reasons. I didn't like his obvious attempts at flattery.

16. His manner was too oily, too clever. My reaction was: "I don't want to play poker with this slicker!"

17. I didn't like the way he presumed to slap my back.

18. He was stuffy and unbending, gave me the impression that he was doing me a favor condescending to talk to me.

19. He looked like an unmade bed. The salesmen who call on me don't have to be Beau Brummells, but I like them to show me the respect of being presentable.

20. He stuck around too long after he'd told his story, talking my ear off and wasting my time.

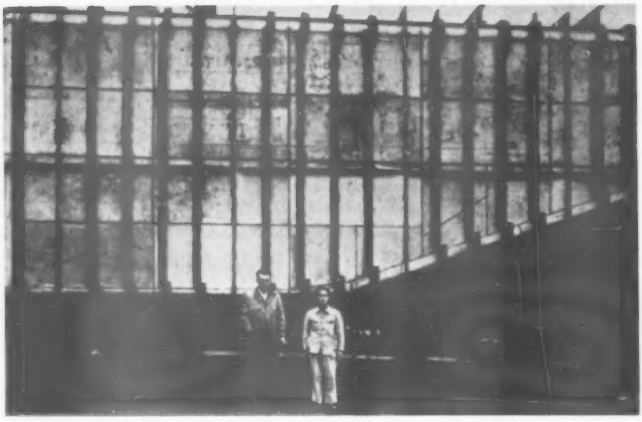
These twelve articles were based on the script of a Dartnell-Borden series of sales films, "Selling against Resistance."

BY JACK MEDOFF

For the information on which this article is based, the writer is indebted to Jiro Iwai, chief of the welding shop of the Nagasaki Shipyard and Engine Works, Japan.

Iwai was in a reinforced-concrete building in the shipyard when the atom bomb fell on Nagasaki. That may have saved his life. While he was on a recent 3-month sponsored tour of American plants and factories, he told us about the fabrication of these stainless-steel all-welded cargo tanks for transporting coconut oil. The ships are part of the program to rehabilitate the Japanese shipbuilding industry that was sponsored under the auspices of former Supreme Commander General Douglas MacArthur.

Japan uses the metric system of measurement. Our conversion figures in inches and pounds are to the nearest round figures.—THE EDITORS.



ABS SURVEYOR J. F. McCann and Welding Chief J. Iwai, Nagasaki Shipyard, in front of stainless-steel tank built to transport vegetable oil cargo

Cleaning Costs

Stainless-steel cargo tanks reduced the cost of between-trip cleanings from the $3,000-$4,000 range to less than $1,000. Here are the welding details.

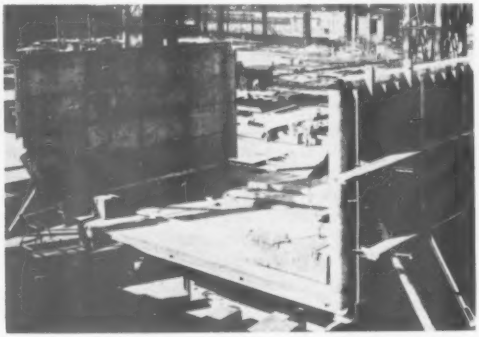
AMONG the fastest cargo liners afloat are the three 9,400-ton passenger-cargo liners built at the Nagasaki Shipyard for the De La Rama Steamship Co., Inc., of the Philippine Islands. These ships have a speed of better than 17 knots when loaded. They carry cargos between Philippine ports and New York harbor via the Panama Canal.

Generally, their cargo from the Philippines includes coconut oil, an expensive commodity that must be carefully guarded against contamination. The return trip usually brings back bulk lubricating oil in the same tanks. Previously, the cost of cleaning the oil tanks after a trip would amount to as much as 20% of the value of the coconut oil. When the new ships were planned, it was decided to cut down the cost of cleaning by using stainless-steel tanks.

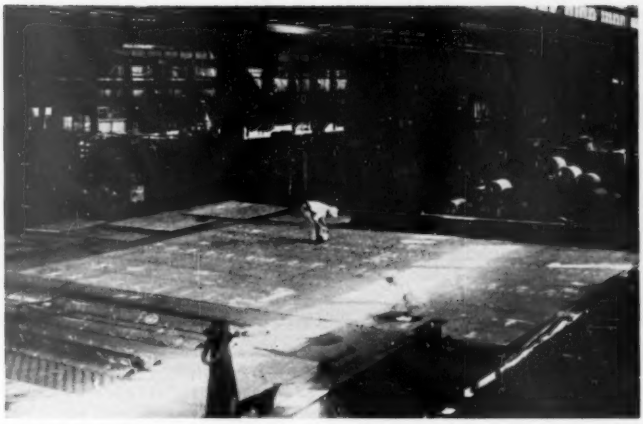
An unusual feature of the all-welded stainless steel tanks is the complete absence of internal supports or bracing. In addition, all corners and plate junctions are rounded. The bulk oil carried is not heated by direct contact with the steam coils. Instead the heating coils are located in separate water tanks under the oil tanks, a more suitable way of heating costly oils.

All the above features make for faster, easier and cheaper cleaning

REINFORCING MEMBERS are mild-steel structural sections. Channels are temporary bracing—tack welds are broken away when the tank is placed aboard ship



FRONT AND BACK attached—all junctions are curved to make cleaning easier. Corner section was shaped by cold rolling a slightly heavier sheet than the walls



LAYOUT FLOOR in welding shop—where sheets for supports and ribbing were marked. Large sheets for tank sides were made by welding small ones

Took a Nose Dive

than with ordinary steel cargo tanks.

Each new ship carries two such cargo tanks, each approximately 30 by 33 by 15 ft, with a combined cargo capacity of over 25,000 cu ft. The tanks are located just forward of the engine room alongside of each other on opposite sides of the ship's centerline.

Coconut oil is a very satisfactory cargo. It solidifies below 80 F and adds stability en route because it is solid at traveling temperatures. The heating coils in the water chambers below the tanks are used to liquefy the oil so that it can be pumped out at its destination. When the ship reaches the Panama Canal, steam is started through the coils so that by the time New York is reached the oil is liquid enough for complete extraction.

Due to Japan's limited rolling capacity, the largest sheets of stainless to be had are approximately 3¼ ft by 6½ ft. To make up the six sides needed per tank, it was necessary to weld more than 200 small sheets together. This does not include the supporting elements.

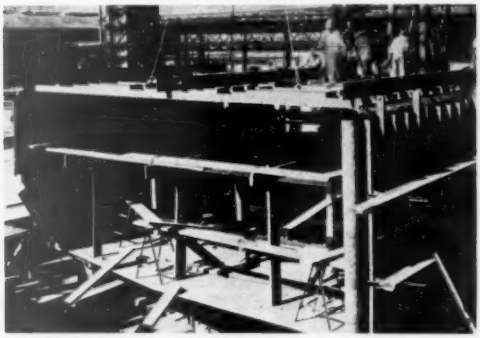
With so much localized welding, it became a real problem to keep the sheets from distorting or warping. Fortunately, the welding shop head had learned his lessons in a hard school. When Jiro Iwai graduated in 1936 as a naval architect from the Imperial Academy, Tokyo, he was immediately employed at the Nagasaki Shipyard in charge of welding the entire hull for the battleship *Musachi*. She was the sister ship of the 70,000-ton *Yamato*, the thought of whose 18-in. main gun batteries kept the Allied navies in an uncomfortable sweat.

Mistakes were not healthy in Japan during the war; time and materials were too expensive. So Iwai rapidly learned how to keep large plate sections and bulkheads from warping. He utilized that valuable experience in the welding of the stainless-steel oil storage tanks.

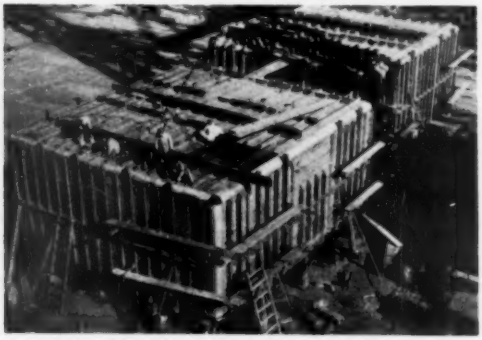
Special precautions were exercised to reduce the effect of the welding heat and to keep distortion to a minimum. To keep the longitudinal stainless welds flat, progressive clamping was done. A steel rail was placed on each side of the groove joint, and a series of 650-lb rollers of 2-ft diameter were stacked across the rails, one right next to the other. As welding progressed, the rollers were advanced over each new portion of completed weld.

In addition, copper chill plates approximately 7/16-in. thick were placed close to the weld zone on each side of the groove joint to restrict the heat-affected zone and so minimize carbide precipitation in the stainless plate.

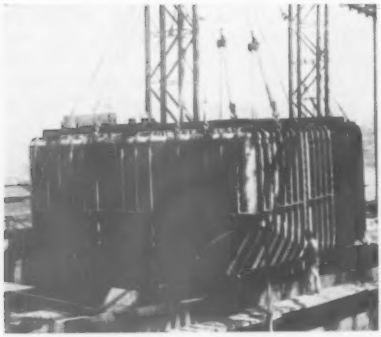
Where stationary concentrated loads were needed, heavy steel boxes weighing approximately 3 tons were used. One is shown in foreground of



TANK TOP has been lifted into position and welded in—only left side remains to be added. Top is ¼-in. stainless plate and measures approximately 30 by 33 ft



FINAL WALL added. Corner cap must be set in and hatch walls must be built up before the two tanks are completed. Their combined capacity is 25,000 cu ft



DOWN SHE GOES—to bottom of No. 3 hold to take up permanent residence aboard ship

TANKS ARE NOW part of the 9,400-ton *Dona Aurora*, which sails between New York and ports in the Philippine Islands and Japan

the lower left picture appearing on page 30.

The tank walls, top and bottom were of 18-8 stainless sheet reinforced on the outside by 3-in. structural L-sections, 6-in. channels and mild-steel plates. The L-sections are welded about 2 ft apart vertically on the walls and along the lengths of the bottom and top. The channels, tack welded to the L-sections, are temporary bracing only; later the tack welds are broken and the channels removed.

The walls increase in thickness from approximately $^{15}/_{64}$ in. at the upper edge to $^{25}/_{32}$ in. at the bottom. The tank top is approximately $^{1}/_{4}$ in. and the bottom about $^{25}/_{32}$ in. thick. The rounded-corner sections were cold rolled from slightly heavier sheet and annealed before being welded.

Manual metal-arc welding was used throughout with a-c and coated electrodes. The only use of d-c was for joining the L-section stiffeners to the stainless sheets. The electrodes used were: 19-9 Cr-Ni for piecing together the 18-8 sheets; 25-20 Cr-Ni to join the stiffeners to the 18-8 sheets; mild steel for joining the L-sections, channels and carbon-steel ribbing. About 1.5 tons of stainless electrodes were used per tank.

Big Sheets from Small Ones

The 18-8 sheets were prepared by a double-vee groove with 60-deg included angles and a root opening of about $^{1}/_{16}$-in. The upper groove was twice the depth of the lower groove and took three passes. The root was then chipped out, one pass added and ground flush. Welding was downhand for both sides. To control distortion, the system using chill blocks and rollers was devised as described previously.

Corner Sections Cold Formed

The heavier-walled curved corner sections were welded in with single-vee joint preparation. The included angle was 60 deg. Welding was vertical and downhand as required. After four or five passes, the root was chipped from the inside of the tank and a vertical or overhead sealing stringer bead added.

The same technique was used for the last piece inserted, the triangular cap that closed the top of the corner section.

With the tank finally sealed, all welds inside were ground flush and smooth.

The supporting L-sections were attached so that the longer leg butted up against the wall. Intermittent fillet welds were made on both sides, three passes each.

To overcome cracking in the intermittent fillet welds attaching the L-supports, ABS resident surveyor J. F. McCann recommended slotting or scalloping the plate of the ell so that the welds would be continuous. McCann represents the American Bureau of Shipping in Nagasaki and is very highly regarded there. Thereafter on all succeeding tanks, slotting the plates became standard practice. It already was customary to scallop a butting plate wherever it crossed a welded joint.

Each completed tank was tested hydraulically for leakage. First it was filled with water, then one additional atmosphere of pressure was added by providing a 30-ft water column over the tank hatch.

With 1,050 welding machines available and much pneumatic equipment, it still took six months to complete two tanks from start to finish—cleaning, preparation, stress-relieving, welding, grinding, finishing and testing.

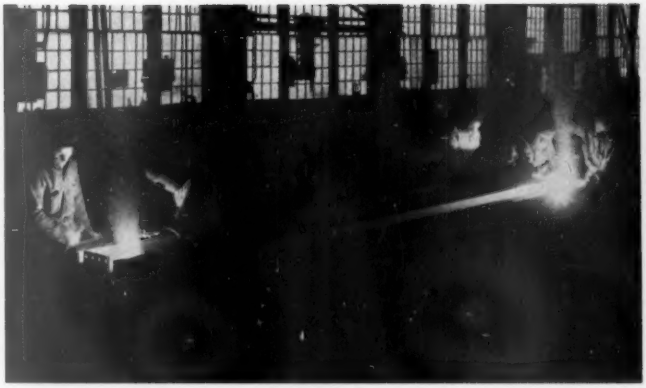
That High Cost of Cleaning

After each trip, the tanks are scrubbed down, cleaned and steamed out. If necessary, dry cargo could be carried as the covers on the tanks are watertight. The high cost of cleaning the regular steel tanks was the reason for switching to stainless steel.

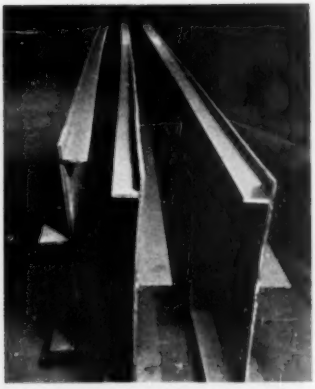
A 650-ton load of coconut oil selling at approximately $30 per ton is worth $19,000. Cleaning costs used to take $3,000-4,000 of this—a high percentage. After the recent maiden voyage of the *Dona Aurora* last March, the final cost of cleaning was less than $1,000, a decided reduction.

These welded stainless steel tanks are exciting a noticeable interest in the industry, according to William Nisbet, of the De La Rama Co. The owners are very pleased with the performance to date and are already planning for more of the same. With the fabrication technique already established, appreciable savings could result both in time and labor if larger sheets were available in Japan.

The new De La Rama ships were designed by Philippine architects and engineers. They conform to AIE classification of the American Bureau of Shipping. In Japan today, all ocean-going vessels are registered either with the American Bureau of Shipping or Lloyd's Registry of London.



1—CONNECTION L'S at ends of the beams are fitted to centerpunched marks (located by the layout department) on the web of each of the beams

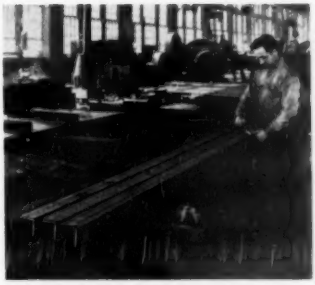


2—BRIDGE BEAMS designed by Cleveland bridge engineering dept.

Fabricated Beams for Welded Buildings*

One reason why there aren't more welded buildings going up may be the meager amount of information in the American Institute of Steel Construction manual.

BY ROSS YARROW
Republic Structural Iron Works, Cleveland



3—LAYOUT MAN lines up angles on skids made from short I-beams

STRUCTURAL fabrication obviously must cover all the processes of steel fabrication, including design detailing, templates, layout, punching, fitting, welding, inspection and erection. I will try to cover some of the fundamentals of each process. First, design.

The designer must plan and proportion the parts so that all anticipated requirements will be met and so that the structure can be built in the most economical way, both in the shop and in the field. Good design obviously means use of the lightest sections with the least amount of weld to carry your anticipated loads. "Design for your shop tools," is a good rule. I'll go along with it, but don't pass up other fabricators' tools if they are available. You can often save much blacksmith labor by taking advantage of a 1,000-ton hydraulic press or a heavy angle roll owned by a fabricator in your neighborhood.

Having arrived at a good design, we must detail the component parts of the structure. Give full information with regard to holes, location of angles, brackets, cutouts, etc., very clearly so that no two persons can arrive at two different answers. Don't be afraid of putting a note on the drawing. If there are any critical dimensions that must be held, then please note that fact.

Any deviation from the standard practices of shop layout should be noted. For instance, if you want to gage holes from the toe of an angle, note it because the usual procedure is to gage from the heel of the angle.

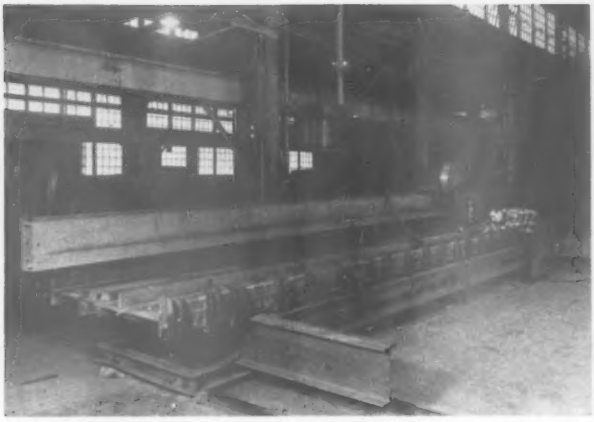
The amount and size of each weld should be put on the drawing, using AWS symbols, of course. And for the love of Mike, spend a little time in actually figuring what the weld you ask for can carry. Don't call for enough weld to carry the Terminal Tower on a piece of steel that couldn't support a two-car garage. I have seen so much overwelding on so many structures that the absurdity is becoming commonplace.

The next step is the preparation of templates. Our template makers check the drawings for material and dimensions as they make the templates. We use paper punch-through templates on connection angles and plate and wood templates for beams and channels. Angles over 2 ft long are racked or jig punched.

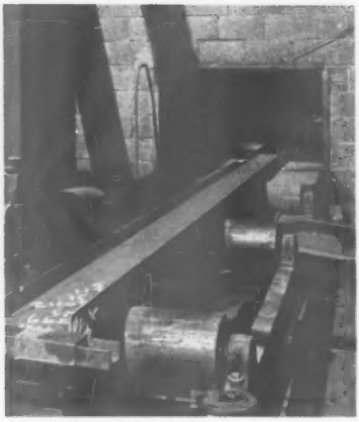
The bills-of-material are sent to the angle shear, plate shear and structural yard, and the templates are sent to the layout department of the structural shop. Layout will check the templates against the drawings.

The layout man works on skids about 28 in. high (Fig. 3). These skids are made from short 20-in. beams for the legs and 8-in. beams for the top. The same skids are used by fitters. The skid is comparatively light and can be easily moved to accom-

* Abstract of a paper given at the twelfth Welding Symposium, Cleveland, AWS, May 11.



4—SUBMERGED-ARC welding of two bridge beams assembled in jig. Clamps on flanges hold distortion of welded beams to about 1/32 in.



5—FRICTION SAW cuts structural shapes, carried on power-driven rolls

modate either long or short material.

With four skids about 16 ft long, the layout man can spread out a large number of beams. With a helper, a good hoist and quick-acting pick-up clamps, he can lay out 5 to 25 tons an hour.

On quantities of angles, the layout man will lay out one piece, which the puncher will use to set up his rack punch. The angle is blocked to gage holes in front of the punch.

The fitter uses up to 10 to 12 skids. These can be temporarily tied together to make a jig for trusses, putting one skid at each panel point outline of the truss. Tack a few stops on the skids to clamp up each member, tack weld them together, take them out and finish weld. Watch out for shrinkage in welded trusses if you weld one side completely while it is in the jig. If your jig is strong enough to restrain expansion while you weld, you will get about $\frac{3}{8}$ in. shrinkage in 60 ft. If your tacked truss is not restricted in movement while welding, you will get very little shrinkage.

Don't take a truss designed for riveting and expect to weld it at a comparable riveted cost. To make a good low-cost welded truss, it must be designed for welding, using beams, half beams or T's instead of angles and gusset plates.

With regard to the fitting up of beams, look at Fig. 1. This picture shows the fitting of connection L's on the ends of beams to centerpunch marks on the web of the beam.

For welding structural members in the shop, we use the larger size rod: $\frac{1}{4}$ and $\frac{5}{16}$ in. E-6012 and E-6010. About 90% of our welding is in fillet welds, mostly one pass.

Having a "bulldozer" (heavy bending press), we don't pay too much attention to distortion. About ten minutes of labor will straighten out most pieces. More time than that would be required to hold it straight with strongbacks, or by peening, step-back welding, preheating and similar methods.

Splicing Heavy Beams

Column bases and caps are generally welded today, even when other seats or brackets are riveted. All lintels are welded today. Most of the time we butt weld to make the longer plates. Do you splice heavy beams by welding without any reinforcement? We do.

In the last shortage of structurals and in this present shortage, we have welded many beams of 18 to 36 in., 150 to 200 lb per foot, and have punched through the weld. We have tested such welded beams in our press by deflecting them more than the designed deflection repeatedly. All of them have come back to their original shape. We have loaded them on trucks with the unsupported welded end, 20 to 24 ft long, whipping in the breeze for three or four hours while en route to the job site. Some of these beams have been in service about six years, and we are not losing any sleep over them.

We prepare the beams for welding by scarfing one edge of the butt joint 45 deg to $\frac{1}{8}$ in. of the thickness of web and flange. We weld completely from that side, using an air-powered chipping hammer to clean between passes. Then we flame-gouge from the other side to make sure that all slag is removed. Finally, we cut back from the edges of the flanges and complete the welding.

We have an outside inspection agency come in to check our welding. I have found that weldors will be extra careful when they know that an outsider will check their work.

The inspector carefully checks the flame-gouging to make sure that the final weld is put on clean metal and to see also that no cracks have developed in the weld. We grind the weld flush on most beams. I think grinding is the better method, as any undercut stands out like a sore thumb and can be easily corrected. We make use of our submerged-arc welder extensively when we can't get the sizes in beams that we need.

Using three plates (two for flange, one for web), we can run a 40-ft continuous weld on our 44-ft travel beam at the rate of 12 to 48 in. per minute, depending on the thickness of our web plate. Using 1,000 to 1,100 amp, you can easily penetrate a $\frac{3}{4}$-in. web plate by fillet welding from both sides.

This submerged-arc welder is an ideal tool to build special sections such as bridge beams. Those shown in Fig. 2, designed by the bridge engi-

6—ASSEMBLING the plates needed to build a large hopper. A 1-in. plate is employed to serve as the bed of the jig (see also Fig. 7)

7—INSIDE CORNERS of hopper were welded with 5/16-in. E-6020 electrodes

neering department of the City of Cleveland, have two different levels—one for the sidewalk and one for the roadway. To keep the flanges from cupping down, we have a special home-made clamp that exerts pressure at the outside edges of the flanges. This clamp has eliminated about 80% of the flange distortion. Fig. 4 shows two bridge beams being submerged-arc welded in the jig. The flange clamps hold distortion to about 1/32 in.

With beams or any section that can be handled easily in our "bulldozer," we don't attempt to control longitudinal distortion. Bulky weldments such as stadium decking—running 6 to 8 ft wide and in sections 20 ft long—are fabricated in jigs that precamber the tacked weldment and hold it down securely while we weld.

Let's look at some of the other pictures. Figure 5 shows our friction saw cutting structural shapes. Power-driven rolls carry the structural member to the saw. The angle at the left of the work has gage slots spaced at 1-in. intervals for quickly and accurately determining the length of the beam being cut. At the end of this angle (not shown in the picture) is a hinged sliding stop.

Figure 6 shows the assembly of plates for a large hopper. A 1-in. plate is used as the jig bed. In Fig. 7 we see the inside corners of the hopper being welded with 5/16-in. E-6020 electrodes to make smooth, rounded corners.

On the erection of a structural building, the designer has three important facts to keep in mind: (1) provide two hole connections for erection bolts. (2) keep out of tight corners. (3) get most of the field-welded connections so that they can be welded downhand.

Our present high cost of welded structural buildings is not caused by shop costs but by erection costs. On two very similar jobs—the Kent University stadium and the Euclid High School stadium—we saved about 50% in erection costs by providing erection bolts.

In spite of the fact that up to recent years most building codes in many of the larger cities had no definite provisions governing their construction, welded steel buildings have gone up by the thousands, in hundreds of cities, due to the pioneering spirit of a few large fabricators and thousands of small fabricators.

Most of the blame for the slow progress in the acceptance of welded structures can be laid at the door of the Manual Committee of the American Institute of Steel Construction. The 1949 edition of the AISC manual devotes better than twenty pages to give you the allowable loads on any type of riveted connections but only three pages on recommended tentative standard details for the various welded connections used in building. It says (as it did back in the 1941 edition): "The art of designing for welding is a new and changing one."

In 1946 Lamotte Grover compiled for the Air Reduction Sales Co. a manual on design for welded steel structures. He used design tables devised by H. W. Lawson and tested for five years by the Lehigh University research program. Full information was given on allowable loads on all connections—beams and channels. Design of girders and trusses was fully covered.

Need Up-to-Date Manual

I think the time has arrived to bring the AISC manual up to date. Bring all the pressure you possibly can on Mr. Higgins and his Manual Committee to see the next edition has all the data needed on welded connections—size of material, amount of weld and the allowable load. This one manual is used by architects, engineers, fabricators and public officials and is recognized by them all as the final authority.

No doubt you have often heard the remark by various men in the welding field, "What can we do to sell welding to the public?" I think the public is sold on welding, but people in the welding field are not and are spending their time in thinking up restrictive measures to throttle welding. Witness, for example, the present trend on the west coast to X-ray all field welding. If we have to come to that, you might as well forget welded buildings; the cost would be prohibitive.

I can see no reason why a good inspector cannot visually inspect a welded building just as well as he does a riveted one. The thousands of welded buildings standing today prove it.

INERT-ARC process joins welding fitting to aluminum pipe

LARGE-SIZE flanges for pipes of a large OD

Welded Aluminum Piping*

Now that the pipe designer no longer has to employ troublesome cast screwed or cast flanged construction, the use of aluminum piping offers many advantages.

BY DAN R. CHEYNEY
Tube Turns, Inc., Louisville, Ky.

With inert-arc welding and a full line of forged aluminum welding fittings and flanges readily available, the use of aluminum piping has expanded tremendously in the last three years.

As is well known, inert-arc welding eliminates the flux problem by blanketing the molten aluminum weld pool with an inert gas to prevent oxidation. Another advantage it offers the aluminum pipe weldor is a narrow heat zone, helpful in minimizing difficulty from distortion and in reducing the area of the joint that is subject to postweld heat treatments.

Alloys for Piping

Mention must be made of the aluminum alloys normally used for welded piping. These alloys, selected because of their commercial availability, weldability, mechanical properties and good corrosion resistance, are: 3S-F, 61S-T6, and 63S-T5. Alloy 3S-F is not heat-treatable, while alloys 61S-T6 and 63S-T5 derive their strength from heat treatment.

Manganese alloy 3S-F has been subjected in the as-extruded condition to a certain amount of strain hardening, which gives it somewhat higher tensile and yield strengths than annealed material. Minimum tensile and yield strengths are 14,000 and 5,000 psi, respectively.

The magnesium-silicon alloy 63S-T6 is the least expensive heat-treatable alloy suitable for welded construction. Its tensile and yield strengths—32,000 and 25,000 psi—are superior to the as-extruded 3S-F or intermediate work-hardened tempers of this alloy.

61S-T6, the magnesium-silicon alloy with 0.25% each of copper and chromium, has the highest strength of the weldable aluminum-alloy pipe materials; namely, 38,000 psi tensile and 35,000 psi yield strength.

Pipe is commercially available in all three of the above alloys. Welding elbows, tees, caps, lap joint stub ends and forged flanges are manufactured in 3S-F and heat-treatable 61S-T6.

The requirements of most chemical piping installations are adequately met by the use of 3S-F pipe and fittings. Alloy 61S-T6 flanges, because of their harder surface and higher yield strength, resulting in higher permissible pressure rating, are generally recommended rather than 3S-F flanges for the 3S-F system. However, forged 3S-F flanges are also available.

Where higher working pressures are a prerequisite, 63S-T6 or 61S-T6 pipe can be used. In this case 61S-T6 fittings and flanges are utilized with either the 63S-T6 or 61S-T6 pipe.

Heat Effect of Welding

The heat effect of welding must be carefully considered. In mild steel, a welded joint has approximately the same strength as the parent metal. With aluminum, the heat of welding tends to lower the physical properties in the area immediately adjacent to the weld to the annealed condition—the lowest physical property level of the particular alloy involved.

If the pipe is already in the annealed condition prior to welding, there is, of course, no appreciable

* Abstract of a paper delivered at twelfth annual Ohio State Welding Engineering Conference, April 13-14 at Columbus.

Table I. Allowable Design Stresses for Power and District Heating Piping Systems

	Aluminum Alloy 3S	Aluminum Alloy 63S	Aluminum Alloy 61S
Form	Pipe and Fittings	Pipe	Pipe and Fittings
Designation	3S-F	63S-T6	61S-T6
Minimum Tensile, psi	14,000	32,000	38,000
Burst Weld Factor*	1.00	0.75	0.75
Subzero to: 100 F	3,000	6,000	7,100
150 F	2,900	5,700	6,800
200 F	2,800	5,500	6,550
250 F	2,600	5,000	6,000
300 F	2,500	4,250	5,000
350 F	2,250	3,400	4,000
400 F	1,850	2,500	3,000

*Burst weld factor: ratio of pressure required to burst circumferentially welded pipe to pressure required to burst unwelded pipe. Burst weld factors are assumed constant over the above temperature range.

Design stresses were obtained by applying burst weld factors to allowable stresses, which are lowest of: *(a)* ¼ minimum tensile strength, *(b)* ⅔ minimum yield strength, *(c)* ⅔ of stress for 1% creep 100,000 hr or (d) stress producing rupture in 100,000 hours at the respective temperatures.

Table II. Allowable Stresses for Oil Piping in Refinery and Gas and Air Piping within Plants

	Aluminum Alloy 3S	Aluminum Alloy 63S	Aluminum Alloy 61S
Form	Pipe and Fittings	Pipe	Pipe and Fittings
Designation	3S-F	63S-T6	61S-T6
Minimum Yield, psi	5,000	25,000	35,000
Yield Weld Factor*	1.00	0.55	0.45
Subzero to: 100 F	3,000	8,250	9,500
150 F	2,900	8,000	9,250
200 F	2,800	7,700	9,000
250 F	2,600	7,400	8,650
300 F	2,500	5,800	7,800
350 F	2,250	3,800	6,600
400 F	1,850	2,600	5,200

*Yield weld factor: ratio of pressure required to yield circumferentially welded pipe to pressure required to yield unwelded pipe. Yield weld factors are assumed to increase to unity at temperatures causing full annealing; *i.e.*, 500 to 550 F.

Design stresses were obtained by applying yield weld factors to stresses that are 60% of minimum yield strength of specimens held for 10,000 hr at designated temperatures.

Table III. Comparison of Allowable Stresses for Welded Pipe and Pressure Ratings

	Tensile Strength psi, min.	Yield Strength psi, min.	Elong. 2 in., % min.	Weld Rod[1]	Allowable Stress, S, psi[2]	Rating 4-in. Std. Wt. Fitting, psi	ASA 150-lb Flange, Rating, psi[3]
ALUMINUM-ALLOY PIPE AND FLANGES							
2S-F or 2S-O							
Pipe, Ftgs. and Flgs.	10,000	3,000	25*	2S	1,800	170	30
3S-F or 3S-O							
Pipe, Ftgs. and Flgs.	14,000	5,000	20**	2S	3,000	285	50
63S-T6	32,000	25,000	10	43S	8,250	790	
61S-T6							
Pipe, Ftgs. and Flgs.	38,000	35,000	10	43S	9,450	900	230
CARBON-STEEL PIPE AND FLANGES							
Grade A				E-6010			
A106 Pipe	48,000	30,000	20***	GA60	18,000	1,300	
Grade B				E-6010			
A106 Pipe	60,000	35,000	12***	GA60	21,000	1,500	
Grade I				E-6010			
A181 Flanges	60,000	30,000	22	GA60			230
Grade II				E-6010			
A105 Flanges	70,000	36,000	22	GA60			230

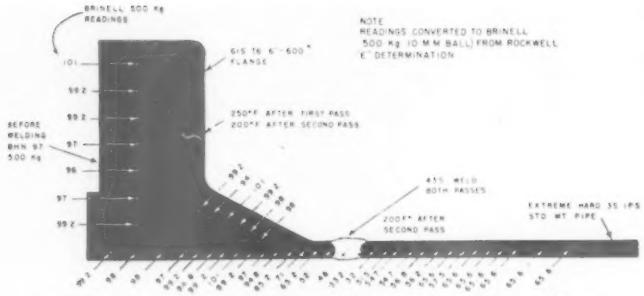
*Reduced from 30 to 25% to include 2S-F **Reduced from 25 to 20% to include 3S-F ***Transverse elongation

[1]In welding 2S-F or 3S-F pipe or fittings to a 61S-T6 flange, use 43S filler rod. Also, in welding 2S-F and 3S-F to each other or to themselves, use 43S rod instead of 2S rod if desired.

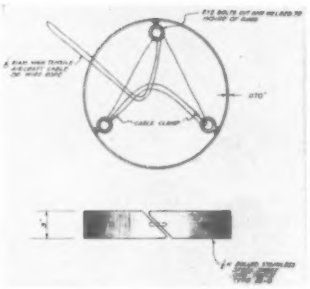
[2]Subzero to 150 F, suitable for aluminum piping with circumferential butt welds within oil refineries, gas and air piping within plants, and general plant process piping. S = 0.60 × factor for butt weld × yield strength of pipe material. Weld factor at room temperature for 2S-F and 3S-F = 1.00, for 63S-T6 = 0.55, for 61S-T6 = 0.45.

[3]Room temperature, 100 F, pressure rating for flanges with facing other than ring joint. Ratings for 2S-F and 3S-F flanges are based on ratio of effective yield strength of aluminum flanges to the minimum yield strength of A105 Grade II flanges.

Welding Recommendation: Argon shielded tungsten-arc process, oxyhydrogen or oxyacetylene.


BRINELL 500 Kg READINGS
NOTE
READINGS CONVERTED TO BRINELL
(500 Kg 10 M M BALL) FROM ROCKWELL
E DETERMINATION
61S T6 6" 600# FLANGE
250°F AFTER FIRST PASS
200°F AFTER SECOND PASS
BEFORE WELDING BHN 97 500 Kg
45% WELD BOTH PASSES
200°F AFTER SECOND PASS
EXTREME HARD 3S IPS STD WT PIPE

1—BRINELL hardness variation near weld of 61S-T6 flange to 3S pipe



2—DETAILS of weld back-up ring

heat effect. This is the condition of 3S-F extruded pipe and forged fittings. And even in the case of 63S-T6 and 61S-T6, somewhat higher than annealed properties exist after welding because of the complex nature of these alloys.

Another factor to remember is hoop stress. While the softened weld zone is under both longitudinal and hoop stress, the hoop stress is twice the longitudinal stress and is, consequently, the principal stress. Thus the softened weld zone will receive reinforcement in the direction of greatest stress from the nearby unaffected pipe. Much of the engineering of welded aluminum piping is to determine the significance of the hoop stress effect so as not to penalize unnecessarily the use of welded aluminum piping.

What Are Weld Factors?

Three years ago engineers were talking in such vague terms about the annealing effect of welding that Tube Turns, Inc. and the Aluminum Company of America thought it necessary to conduct extensive tests. Aim was to determine the extent of the annealed condition after inert-arc welding of the various alloys for welded piping.

In this connection, so-called "weld factors" were developed to compare the aluminum welded joint to a comparable section of unwelded pipe. These factors provide a direct comparison of lengths of unwelded pipe to lengths of butt-welded pipe under the hydrostatic pressure that is required to produce initial yielding and finally bursting. Tests were first run by Tube Turns in the 4-in. schedule 40 pipe size and later confirmed by the Aluminum Company of America in the 2-in., 4-in. and 8-in. schedule 40 pipe sizes. In one case the weld factors are based on ratios of bursting pressures—pressure needed to burst pipe with circumferential butt welds to pressure required to burst unwelded pipe. In another case, the weld factors are based on similar ratios of yield pressures—pressure to yield pipe with circumferential butt welds to pressure to yield unwelded pipe. The reason why both burst and yield factors are of interest is that various sections of the ASA piping code are based on either the ultimate or yield strength of the material involved. It was felt that the application of such a ratio or weld factor to the minimum properties of the aluminum alloy involved would provide a suitable design strength for welded aluminum piping.

Tables I and II show how the weld factor for bursting and the weld factor for yielding may be used in determining design stresses according to procedures set up in the ASA Code for Steel Piping. These two tables list allowable design stresses at specified temperatures for aluminum pipe and fittings with circumferential butt welds. Table I gives the stresses that are allowable for piping used for power and district heating systems; Table II the stresses allowable for oil piping within refinery limits and for gas and air piping within plants.

You will note from these tables that the weld factors for the heat-treatable 63S-T6 and 61S-T6 alloys are appreciably less than those for the non-heat-treatable 3S-F alloy. Nevertheless, the use of the heat-treatable alloys is recommended when higher design pressures are desired. The much higher minimum physical properties of the heat-treatable alloys more than offset their lower weld factors.

Alloy 3S-F has a weld factor of unity since its properties for design purposes have been based on the annealed state. Extruded 3S-F pipe and forged 3S-F fittings are formed hot, generally in excess of the annealing point. For this reason annealed properties are assumed for design purposes. However, properties may be slightly in excess of the annealed values. This is due to the slight work hardening resulting from the hot extrusion process.

In the argon-shielded tungsten-arc welding of aluminum flanges, the extent of the annealing has been shown to have little effect on the strength. This effect extends back only three to five times the thickness of the pipe wall on each side of the weld. Hence fully heat-treated forged aluminum 61S-T6 flanges can be rated the same as comparable ASA flanges made of carbon steel. This is one reason why it is often advantageous to use a 61S-T6 flange with a 3S-F piping system.

Example: a 150-lb ASA-dimensioned 61S-T6 flange would have an approximate rating of 230 psi at 100 F, the same rating as a flange of carbon steel; 3S-F flange of comparable dimensions would only have a rating of 50 psi. Figure 1 shows the Brinell hardness variation on the cross-section of a forged 61S-T6 flange welded to a length of work-hardened 3S pipe. Note the limiting extent of the softened area.

Table III compares the ratings of aluminum-alloy pipe and flanges with carbon-steel pipe and flanges. This tabulation of relative ratings will help the engineer desiring to compare various aluminum-alloy fittings and flanges with low-carbon-steel fittings and flanges. These figures are based on minimum property values (as supplied by the Aluminum Co. of America) and the use of these properties according to conventional ASA prac-

WELDED aluminum piping in plant

tices of computing allowable working pressures. It should be emphasized that the ratings are subject to minor revision, depending on future research and code adoption. The fitting ratings are based on the 4-in. standard weight pipe size, while the flange ratings apply to all sizes.

Welding Positions

There are certain other characteristics concerning aluminum pipe welding that should be pointed out. All of the aluminum alloys discussed—3S-F, 63S-T6, and 61S-T6—can be welded in all positions: rolled, vertical and fixed horizontal. The fixed horizontal position is the most difficult and should be avoided whenever possible; nevertheless this type of weld must be made occasionally. In making the fixed horizontal weld, it is helpful to widen the standard 37½-deg welding bevel to about 55 deg at the bottom of the pipe. This will aid in holding the molten puddle in place. Also, an increase in the flow of argon gas will help to prevent porosity, which has a tendency to occur in the bottom half of the weld made in the fixed horizontal position.

Best results are obtained when the piping is prefabricated in the rolled position to the greatest possible extent and the closing joints made by means of welding neck flanges. This avoids any horizontal fixed position welds.

The filler rod for use with 3S-F pipe can be either 2S (commercially pure aluminum) or 43S (5% silicon). The 2S rod will produce a weld of slightly higher ductility, but some weldors find that it is easier to lay the weld bead when using the lower melting 43S alloy.

For welding both 63S-T6 and 61S-T6, either to themselves or to 3S-F, the 43S rod must always be used. Stresses set up in the welding of the more complex heat-treatable alloys require that a filler rod with a somewhat lower melting point than the parent metal be used to avoid cracking.

Back-up Rings

Using the standard 37½-deg welding bevel with a 1/16-in. land, a slight gap of about 1/32 in. is usually desirable when making a butt weld. If it is feasible to use a welding ring to back up the inside of the welded joint, a somewhat greater root gap can be used. Two types of back-up rings have been in commercial use. One is a removable stainless steel strip rolled to the ID of the pipe. Figure 2 gives the details of this type of back-up ring.

Another type of welding ring is simply a piece of aluminum strip varying from ½ to 1 in. in width and 0.064 to 0.125 in. in thickness, depending on conditions. This strip is rolled to the ID of the pipe and tack welded into position prior to fit-up and final welding. The aluminum strip becomes part of the final installation. Where maximum corrosion resistance is desired, don't use such a strip since a crevice condition exists afterwards.

Guided Bend Test

Extensive guided bend tests of weld strip specimens, conducted according to the ASA Code for Pressure Piping and the ASME Boiler Construction Code, show that sound welds made between 3S-F components will pass the 180-deg face-bend test. Results on the 180-deg root-bend test will vary from excellent to failed. Most of the difficulty is experienced in the weld strip removed directly from the bottom of the horizontal fixed welding position.

The guided bend test for qualification of procedure and operation on ferrous materials has long been in the Code for Pressure Piping. While regarded as the simplest and best test to demonstrate weld soundness of ferrous materials, it is admittedly a very severe test and may not be wholly justified for pipe intended for mild service conditions. This is even more true of aluminum piping and especially of the heat-treatable alloys. It is possible to produce welds in 3S-F pipe that will pass the guided bend test, but it is quite difficult to do it in the horizontal fixed position when the test specimen is cut from the bottom of the pipe. In the case of the heat-treatable alloys 63S-T6 and 61S-T6, it has thus far not been found possible to pass the guided bend test since the metal in the weld area does not have the necessary ductility *even when the weld deposit is perfectly sound*. This suggests the possibility that the quality of the metal after fracture—its freedom from gas pockets, inclusions and porosity—should be the criterion rather than the degree of bending the specimen will withstand without cracking.

A small number of fatigue tests were made on piping assemblies consisting of 4-in. 3S-F and 61S-T6 pipe of standard weight and 150-lb 61S-T6 flanges. The results indicate that the endurance strength of welds in these materials bears about the same relationship to that of welds in carbon steel piping as the suggested allowable working stresses based on weld factors in Tables I and II bear to the allowable working stresses for ASTM-106 Gr. B pipe established by the Code for Pressure Piping. If additional tests now in progress substantiate this conclusion, it may be possible to demonstrate that there is no absolute necessity for welds in 61S-T6 piping to be capable of meeting the Code requirements concerning bend tests.

Where It Can Be Used

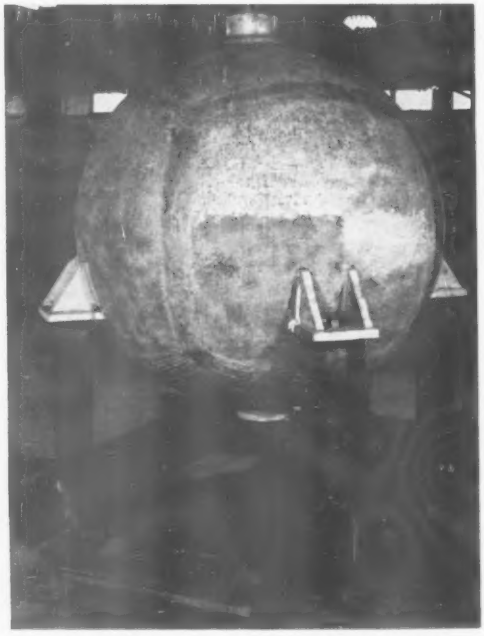
Except for the low-alloy steels, aluminum is the lowest cost corrosion-resistant piping metal available today; its cost is only twice that of low-carbon steel. For that reason, its use is growing rapidly. To date, aluminum pipe and aluminum forged welding fittings and flanges have been used for: low-temperature gases, concentrated nitric acid, hydrogen peroxide, water, fatty acids, turpentine, ammonium nitrate production, synthetic fiber production, gas transmission, oil transmission, glacial acetic acid, furfural, manufacture of drugs, resins and rosins, mercaptans and waxes among others.

Now that the pipe designer can substitute welding for troublesome cast screwed or cast flanged construction, the use of aluminum piping should continue to grow.

1—SIX FLAT plates were formed to proper spherical curvature in above 1,500-ton press

2—EDGE BEVELING and trimming were done in one operation with a shape-cutting machine, using the powder-cutting process

3—CHECKING WELDS for surface imperfections. Red dye penetrant makes even fine hairline cracks visible



4—COMPLETED sphere has 54-in. OD, holds 200 gal of liquid nitrogen at a working pressure of 5,590 psi

Welded Sphere for Liquid Nitrogen

Maybe you'll never have to handle such a job as this, but you'll probably be interested in how it was done. Sphere was of 347 stainless and had a wall 3½ in. thick.

BY FRED M. BURT

RESEARCH Welding & Engineering Co., of Los Angeles, has devoted major effort during the past six years to fabrication problems peculiar to the rocket and jet-propulsion fields. Engineering, precision machining and diversified welding operations are carried on under the personal direction of co-partners John A. Toland and William F. Bennett.

An interesting recent job was the fabrication of a 200-gallon stainless-steel sphere to hold liquid nitrogen. This sphere has an OD of 54 in., a wall thickness of 3½ in. and was fabricated of type 347 stainless steel in accordance with paragraph U-200 of the ASME Code for Unfired Pressure Vessels. Calculated burst pressure is 23,000 psi, which leaves a large margin of safety since the working pressure is 5,590 psi.

Gaseous and Liquid Nitrogen

The sphere was delivered to Edwards Air Force Base, Muroc, Calif., to be used by the U. S. Air Force in rocket-propelled aircraft experiments and flight testing. Gaseous nitrogen in large volumes and at extremely high pressures (on the order of 6,500 psi) is required in testing all rocket-engine aircraft. Nitrogen at lower pressure is also used to expel the propellants and oxidizers from the fuel tanks of supersonic aircraft.

Gaseous nitrogen at the high pressures required cannot be transported over public highways as commercial carriers are limited by the Interstate Commerce Commission to a pressure of 2,200 psi. The solution is to transport the nitrogen as a liquid and use an evaporator system to supply the gaseous nitrogen at the needed pressure.

Liquid nitrogen is fed by a gravity-feed system from the air base's permanent storage equipment to the 200-gallon sphere. Then the liquid nitrogen is forced from the sphere under pressure into an evaporator (heat exchanger). Gaseous nitrogen at any desired pressure up to about 10,000 psi can be produced by controlling the boil-off rate of the liquid.

What Shape to Use

The 200-gallon sphere had to be suitable for a working pressure of 5,590 psi at the extremely low temperature of –320 F. Many complex problems were encountered in producing it.

To begin with, it wasn't at all sure that the shape of the vessel should be a sphere. Maybe a barrel would be more economical. The question of shape was left up to the slide rule and calculus boys. It worked out that the barrel-shaped design would have weighed about 15,000 lb to hold the same volume as the 54-in. sphere weighing 7,500 lb.

So it was to be a sphere. Yes, but there are many different ways of putting a spherical shell together. A six-segment construction was chosen after careful appraisal of available shop facilities and the facilities of outside shops doing this sort of work.

The question of what material to use was the next consideration. Case histories were studied on other liquid nitrogen and liquid oxygen vessels fabricated by the Research Welding & Engineering Co. during the past two years. Charpy impact values of parent and weld metals were compared as well as hot-forming characteristics of various plates. Finally, columbium-stabilized type 347 stainless was chosen as offering the best combination of desired qualities. Plates were ordered from the mill in a size of 38 by 38 by 3.687 in. This allowed adequate stock for trim after the segments had been formed.

Code Requirements

All joints were designed to meet paragraph U-200 of the ASME Code for Unfired Pressure Vessels. Paragraph U-200 pertains to a double-welded butt joint or equivalent single-welded butt. It requires radiography, stress relief and a joint efficiency of 95%. Weld reinforcement must be removed substantially flush with the surface of the plate.

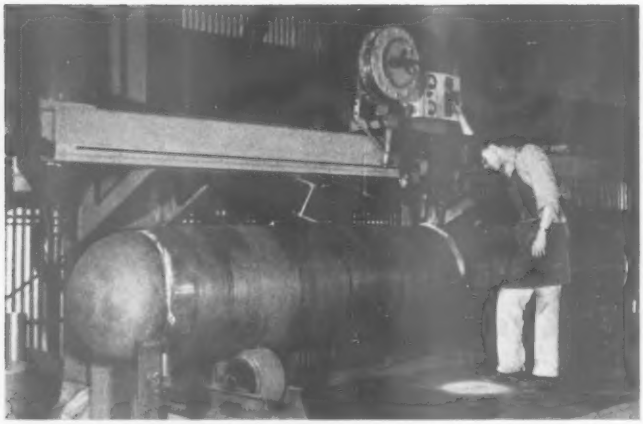
First step in the fabrication was, of course, the forming operation (Fig. 1). The National Supply Co., Torrance, Calif., which contracted to do this work, did not have a press large enough and so had to use the 1,500-ton hydraulic steam forging press belonging to the United Engineering & Foundry Co. Male and female dies were cast from carbon steel. The six plates were heated to 1,800 F and formed hot in the 1,500-ton press. The formed segments were then placed in a stress-relieving furnace for gradual cooling from 1,600 F.

Edge Preparation

A highly necessary job was to trim the segments to exact size and bevel the four edges of each segment for welding. A preliminary cost analysis indicated that the powder-cutting process, using an iron-rich powder, would effect a major saving in both time and money over any machining method that could be devised. It was found that the segments could be beveled as they were trimmed.

A 25-deg bevel was selected as most suitable for the welding sequence to be used and the required 95% weld joint efficiency. Before any cutting was done, the segments were assembled into a sphere so that the amount of stock to be removed could be gaged. This preliminary layout also insured that there would be stock enough for the weld bevels.

Fig. 2 shows the flame-cutting of one of the segments. A shape-cutting machine was used with one cutting torch and a tracer following a template. The fine iron powder (200 mesh) was blown by compressed air into the cutting flame through an outer circle of holes in the torch tip. The powder was led through an auxiliary air hose from the powder dis-



5—SUBMERGED-ARC welding of a circumferential seam on a 40-cu-ft storage tank to hold gaseous nitrogen for the tanks of rocket-engine aircraft

penser to the cutting tip. It mingled with the stream of cutting oxygen to release large quantities of heat and create superheated particles of iron oxide (at temperatures of up to 9,000 F).

A heavy-duty grinder removed slag and residue from the flame-cut edges, after which the segments were pickled to insure clean surfaces for welding.

The segments were fitted together for welding. Fit-up was simplified by the use of curved back-up strips of 1 by 3/16 in. material to support and align all of the segments until the root passes could be made. The initial passes were made by inert-arc welding to insure maximum penetration with minimum burn-through of the back-up strip. After the initial inert-arc welds were holding the sphere together, the joints were filled by metal-arc welding (see front cover illustration).

A 3/16-in. lime-coated electrode having a core wire of AWS classification number E 347-15 was applied by reverse polarity d-c. This electrode was selected after many different electrodes had been shop tested and the results analyzed by the engineering department. Important requirements were compliance to the ASME Code for Unfired Pressure Vessels and the ability of the deposited metal to meet Charpy impact test values of 15 foot-pounds minimum at a test temperature of –320 F.

To indicate the scope of this job, 1,150 lb of the above-described electrode were deposited to fill the joints.

Inspection Methods

Two intermediate gamma-ray inspections were made on all welds as the work progressed in order to keep a constant check on the welding procedure and to insure maximum integrity of welds. Welds were also carefully checked by dye-penetrant inspection (Fig. 3). This process (see page 38, The Welding Engineer, Sept., 1950) uses a liquid dye of unusually high capillary action to uncover surface flaws. A quick-drying developing solution provides a white background upon which flaws no bigger than hairline cracks show up in vivid scarlet. Though dye-penetrant inspection will not reveal internal defects (unless they extend to the surface) it will detect very small flaws that might not be discernible by other means.

"We consider weld inspection most important in structures of this type," said Mr. Toland. "By combining gamma-ray and dye-penetrant inspection, we feel that we are able to establish unquestioned weld integrity."

After inspection, the sphere was heat treated in a car-type furnace at 1,950 F for 3½ hours. It was then moved quickly under a series of "shower baths" for rapid quenching by high-pressure sprays. It took only three minutes to lower the temperature of the sphere from 1,950 to 350 F. However, 450 gallons of water were discharged in those same three minutes. After quenching, the vessel was pickled and passivated to remove all scale and foreign matter. The completed 54-in. sphere is shown in Fig. 4.

Charpy Impact Tests

One of the ASME Code requirements was that Charpy test specimens be run on test plates of the same material that have been given the same heat treatment as the pressure vessel. Charpy specimens for impact resistance are vee-notched specimens of specified dimensions. The energy that the notched specimen is able to absorb is measured in foot-pounds.

Again we quote Mr. Toland:

"Radiographic inspection of the completed unit after heat treating had determined that it was sound and acceptable. However, hydrostatic testing of the vessel could not be considered until after the very important Charpy test had been complied with. Paragraph U-142 of the Code does not sound particularly impressive from the requirement point-of-view. We had been sufficiently impressed by previous experience, however, to realize that the acceptability of our product up to this point did not mean a thing unless the results of our Charpy tests were to meet with Code demands. This test actually determines the acceptability or rejection of: (1) the material; (2) all welding; and (3) heat treatment. To have any of these important factors questioned at this stage would be enough to make the most confident of engineers go into a fast huddle with his calculations.

"Results of our test were very gratifying. The average of all specimens was 26.6 foot-pounds with a low of 21.0 foot-pounds. Hydrostatic testing of the sphere to 8,950 psi was a routine matter. The successful functioning of this vessel in the nitrogen evaporator system for which it was designed has made it possible to deliver pressure and volume in excess of present requirements."

Aircraft nitrogen tanks are supplied from 40-cu-ft storage vessels, which hold gaseous nitrogen at a working pressure of 3,000 psi. In connection with the same nitrogen system for Edwards Air Force Base, Research Welding & Engineering Co. fabricated a number of these cylindrical tanks. Figure 5 shows a girth seam being submerged-arc welded on one of them. Shell thickness at girth is 2.250 in., and head thickness is 1 in.

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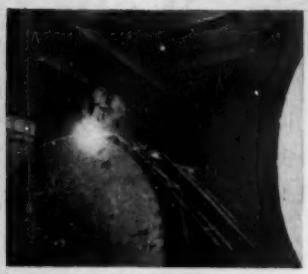

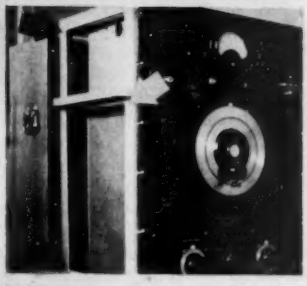

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. . . easier and faster to use than conventional grades of welding rods . . . yet yielding vastly superior results and lasting satisfaction . . .

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Weld Inspection in Britain

A radioactive iridium isotope (Iridium-192) is now being used by British industry to inspect welds, says this letter from a London correspondent.

Editor, THE WELDING ENGINEER,
Chicago, Ill., U.S.A.

Dear Sir:

Will you permit me to say a few words about the article "Cobalt-60 Used for Weld Inspection" written by W. L. Schwinn, of the Babcock & Wilcox Co., and appearing on pages 24 to 28 of your December, 1950 issue?

Our experience here is not backed by the research and laboratory facilities which undoubtedly are at the disposal of Mr. Schwinn, but we have done a great deal of practical work and possess therefore an empirical knowledge which may assist some of your readers.

Mr. Schwinn suggests that a 0.08-in. lead filter should be used in front of the film, which is already enclosed by back and front lead foils. We never use such a filter and probably gain some time without disadvantage. We find that 0.005 in. (or the standard British industrial X-ray lead foil of 0.006 in.) in front and a foil of 0.01 in. behind (or two standard 0.006 in. back to back, lead outwards) are perfectly adequate. The results are excellent. But we never use anything thicker than 0.01 in. in front.

We would not use Cobalt-60 on anything thinner than 1½ in. or 2 in. unless we had nothing else. But we have Iridium-192, which gives radiographs comparable or superior to most X-ray tubes. It would not be of great value beyond 2 in. but for a 1-in. weld it is infinitely superior (in practical work) to Cobalt-60.

I do not think that it is quite fair to compare 1-in. gamma-radiographs made with Cobalt-60 to X-radiographs. It would be fair, however, to compare a gamma-radiograph made with Iridium-192 on ¼ in. to 2 in. plate and a gamma-radiograph made with Cobalt-60 for steel thicker than 2 in. with an equivalent X-radiograph.

The time factor is important. Undoubtedly gamma-radiography takes longer. Very large Cobalt-60 sources with a high radiation output require heavy shielding and become almost as static as an X-ray tube. The majority of plate or tube weld work is in the range below 2 in., and Iridium-192 requires very little shielding and therefore remains mobile. Our small portable machine has a maximum capacity of 300 millicuries of Cobalt-60 and will take comfortably 20 curies of Iridium-192. True enough the half-life of Iridium-192 is only 70 days, but sources can be "reheated" whenever required, and strong isotopes can be maintained in service by having two or three sources to alternate.

The longer exposure time is no great disadvantage. A well planned inspection service will make use of night hours as isotopes do not require any attendance while exposure is in progress. The advantage of higher mobility is important.

A cost calculation must take into account the cost and time of transport. By way of example: How long would it take to bring a boiler weighing several hundred tons from the workshop to the X-ray building, place it in position and examine several circumferential welds by rotating the boiler for different film placements? The same work may be done overnight in the welding shop itself, outside working hours, without moving the boiler at all, by placing isotopes into the central axis of the boiler and covering the weld with overlapping films. A stock of half a dozen isotopes can work in six different places at the same time under a single operator.

Another not negligible point is that Mr. Schwinn's cost calculations refer only to the cost of the X-ray machine. He has completely overlooked the cost of the building required to house the machine. A 2-megavolt generator is hardly an instrument to be left lying around in the open. The building to house it, judging from the equipment used by Babcock & Wilcox in England, is equipped with a traveling crane, rails, bogies, observation window and heavy lead screening all around. Such plant cost cannot at a modest estimate be less than the capital cost of the generator itself. No similar housing is required for equipment containing radioactive isotopes.

The average engineering firm must look twice at a capital expenditure of $50,000 for the generator plus probably another $50,000 for the building to house it. An up-to-date gamma-radiographic outfit including the control instruments can be obtained for approximately $500 and certainly for not more than $1,000.

Examining the use of isotopes from the point-of-view of a "substitute" for X-ray equipment is, of course, altogether wrong, and I think this is the point where Mr. Schwinn's otherwise most interesting article goes astray. Isotopes (and I mean Cobalt-60, Iridium-192 and Tantalum-182) have a quite different function to fill in industrial gamma-radiography. Their field of application is different altogether, and the fact that they can be used as a substitute in some cases is merely coincidental. We operate a large radiographic service station equipped with static X-ray tubes, mobile X-ray plants and radioactive isotopes. They all pay for their upkeep—each in its own way. The testing engineer must carefully weigh their various advantages and disadvantages.

I cannot help feeling that Mr. Schwinn is quite involuntarily biased in favor of his certainly very beautiful X-ray equipment, but I can assure him that isotopes are of great interest to many people who cannot command or cannot justify the expense of a 2-megavolt generator.

Perhaps a minor point, but not without interest, is that a 2 by 2 mm iridium source has a focal spot considerably smaller than the average X-ray tube and allows near-distance work. This, of course, reduces exposure time and therefore reduces the cost per exposure.

M. FALK (Signed)

M. Falk & Co., Ltd., Export Manager
to Gamma-Ray, Ltd., Smethwick, England.

EDITOR'S NOTE: *We don't believe Mr. Schwinn was extolling or attacking any particular inspection process but was endeavoring to present a factual comparison. We are very much interested in your use of Iridium-192, Mr. Falk. If any of our readers would like more information, we'll tell them to write to you at 108 Cambridge St., London SW1, England.*

WHY IT PAYS

to reclaim worn forging dies with "HASTELLOY" Alloy C

Trade-Mark

Rebuilt Dies Often Last Longer Than New Ones:

Besides eliminating the total loss of scrapping a worn forging die, rebuilding dies with HASTELLOY alloy C frequently makes them last longer than new ones. Most shops have found that repaired dies last 2 to 3 times longer than the original metal. Also, when a reclaimed die finally does wear, it can be machined and faced again.

HASTELLOY Alloy C Is Easy To Apply:

Alloy C rod can be easily applied to the worn contour and part lines of old forging dies. Preheating is seldom necessary except to speed welding of very large dies. The rod can be applied to any of the common die steels by arc welding.

Deposits Are Machinable:

When deposited, HASTELLOY alloy C has a hardness of about 200 Brinell. It can be machined by any of the common diesinking tools. Grinding is not necessary.

Peening Is Eliminated:

There is no need to peen or hammer a HASTELLOY alloy C deposit. Deposits work-harden in service to from 325 to 375 Brinell and have excellent resistance to chipping and spalling.

For further information on rebuilding worn forging dies, get in touch with the nearest Haynes Stellite Company district office. Ask for a copy of the new "Haynes Hard-Facing Manual," which tells how to apply HASTELLOY alloy C and many other HAYNES hard-facing rods.

HAYNES TRADE-MARK *alloys*

"Haynes" and "Hastelloy" are trade-marks of Union Carbide and Carbon Corporation.

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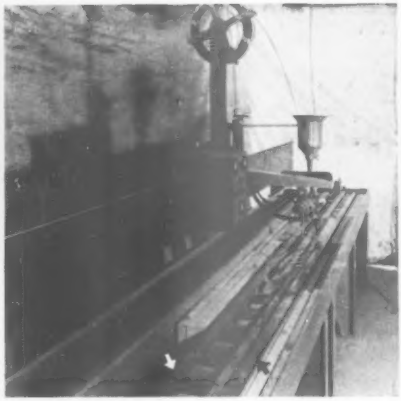
New products



BUILDING UP worn crawler tractor tracks automatically saves 90% man-hours. Overhang (left) leaves room for welding with rotary positioner

COMPRESSED air and electric arc gouging tool speeds metal removal

Rebuild Crawler Tracks With New Welding Machine

COMPLETE rebuilding of the tracks on crawler-type tractors is now a practical operation using the new "ConservAll" welding machine. The complete apparatus includes an a-c welder, a Unionmelt submerged arc welding head, flux recovery machine, hig-frequency starting unit and a sturdy, welded rail and cradle fixture. The fixture comes in 10-ft sections for any length desired.

As much as 1,000% saving in time can be achieved with the "ConservAll" says the manufacturer. While manually welding a 20-ft long crawler track usually takes 30 to 40 hours, this machine will do a higher quality job in 4 to 5 hours. In the picture above, one surface of the track has been rebuilt (white arrow) and other side is beneath the welding electrode and flux. Copper bars (black arrow) alongside the weld serve as a chill bar and shape the molten weld metal. Above picture shows welding with 5/32-in. carbon-manganese filler wire at 550 amp. Adjustable stops on a small rail along the rear of the machine are set to automatically stop and start welding at each link separation. The h-f starter blasts a new arc through the flux for automatic starting.

Special feature of the "ConservAll" is its adaptability to both straight, flat shapes and circular ones such as idlers or rollers. To resurface circular parts, you just move the welding head over on the overhanging portion of rail (see left above). Any standard small rotary welding positioner or lathe arrangement fits under the rail to carry the idler or wheel. This feature is said to save the user a large additional investment if he has both straight and rotary surfaces to rebuild.

PENN TOOL & MACHINE CO., Danville, Ill.

* * *

Rubber Frame Goggle Holds Out Fumes

A GASTIGHT seal is provided by the rubber frame of the new AO No. 701 goggle. There are no ventilation slots. The headband of the goggle enters slots in the outer goggle frame and not through a slit in the lens. The screw-head bolts on the goggle front are made of stainless steel. This goggle can be obtained in combination with respirators.

AMERICAN OPTICAL CO., Southbridge, Mass.

New Cutting Torch Uses Only Compressed Air, Current

THE new "Arcair" gouging and cutting torch removes defects in castings, forgings, welds, etc., and cuts or bevels steel, brass, bronze, monel or iron. It operates on compressed air and current from a d-c welder. Being very compact, it can be inserted in narrow spaces to remove pinpoint defects.

Said to be five times as fast as chipping, it is claimed to gouge a 3/8-in. groove at two ft per minute. A little larger than an ordinary electrode holder, it has an air control valve and a rotating nozzle. It uses special consumable graphite or coated metal electrodes. The torch outfit includes a concentric cable. No regulators or cylinders are required.

Users include major steel plants, shipyards, foundries and pipe manufacturers on the West coast, says the company. (Also see THE WELDING ENGINEER, February, 1951, page 24)

AIRCAIR CO., P. O. Box 1792, Station A, Bremerton, Wash.

* * *

2,000 F Indicator Announced by Tempil

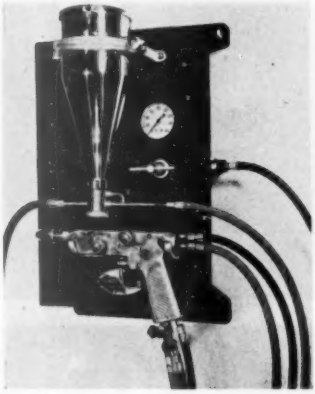
A temperature of 2,000 F can be accurately indicated by a new "Tempilaq" compound. Previous high for this compound was 1,950 F. It is available in 12 or 13 degree steps from 113 to 400 F and in 50-deg

for welding

steps from 400 F up.

TEMPIL CORP., 132 West 22nd St., New York City 11.

* * *



Improved Metallizing Gun Easier to Operate

EIGHT new features make the Model B "Spraywelder" easier to use and more efficient in applying metal overlays. The "Sprayweld" process deposits Colmonoy hard-facing alloys as well as metal powder castings of copper, brass, stainless, aluminum and zinc.

The new features include: lighter weight, eye-level air gauge, greater capacity air filter, air regulator at convenient height, better air and powder control valves, finger-tip lock for trigger for continuous or intermittent spraying, bigger cooling chamber in head and lock-feed mechanism on carburetor to prevent change in powder feed settings.

WALL COLMONOY CORP., 19345 John R St., Detroit 3.

* * *

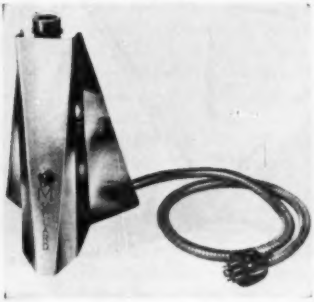
Rod to Braze Weld Dirty Cast Iron

VERY good tinning action is claimed for the new EutecRod 148FC, a braze-welding rod. It can be used to join old, corroded or dirty cast iron, says manufacturer, without extensive chamfering or other preparation.

Each rod is covered with a special flux coating. Tensile strength of the deposit is said to be 55,000 psi with a Brinell hardness of 75-120. It is claimed to be the first such rod that can be used in both chamfer joints and square butt joints.

EUTECTIC WELDING ALLOYS CORP., Dept. TIS, 172nd St., and Northern Blvd., Flushing, N. Y.

* * *



Ultrasonic Soldering Bath Aids Aluminum Joining

THE rapid tinning of small aluminum and aluminum alloy articles is greatly aided by a new "ultrasonic" soldering bath. It is said to be particularly usful for such items as foils, wires and tubes.

Apparatus consists of a small soldering bath $\frac{7}{8}$ in. in diameter and $\frac{3}{8}$-in. deep that is heated by a resistance winding. The molten solder in the bath is agitated ultrasonically by means of a magnetostriction transducer. A control switch on the front of the case enables the ultrasonic energy to be applied at will.

Rapid vibration of the bath, resulting from the magnetostriction effect (see THE WELDING ENGINEER, February, 1951, page 17) breaks up the oxide films that cause trouble in soldering. Articles to be tinned are simply immersed in the molten solder and the ultrasonic energy switched on. No flux is required and either soft or hard solders can be used.

The soldering bath is 6 by 6 by $9\frac{1}{2}$-in. and weighs 4 lb. The power assembly is 9 by 10 by 12 in. and weighs 40 lb.

MULLARD OVERSEAS LTD., Century House, Shaftesbury Ave., London, W.C. 2, England.

* * *

Weldor's Protractor Shows Piping Angles

PRACTICAL measurements of angles in piping layouts, and other jobs is provided by a small plastic protractor. Its special advantage is that it gives readings for outside angles (such as bend or deflection) as well as readings for inside angles. In addition, you can read in.-per-ft against degrees up to 24-in. per ft. The calibrations are at the end of the radius to enable accurate readings of fractions. Size is about $3\frac{5}{8}$ in., weight is $1\frac{1}{2}$ oz. It is made of vinylite plastic.

INTERSTATE SALES CO., 123 East 18th St., New York City 3.

* * *

Bench Welder Joins Jewelry Components

BOTH spot welding and resistance soldering and silver brazing of small parts can be performed by the new Joval Model "1000 WV" and "2000 WV" bench welders. A timer and a heat control with 11 adjustments provide a wide range of joining capacities.

Useful for resistance silver soldering, the machine is claimed to solder brass up to $\frac{1}{8}$ in. thick.

For certain applications, horizontally mounted electrodes are available —the machines are designated "1000 WH" and "2000 WH." On all models, uniform soldering time, heat and holding pressure are maintained by the electrodes, once the foot switch is held down.

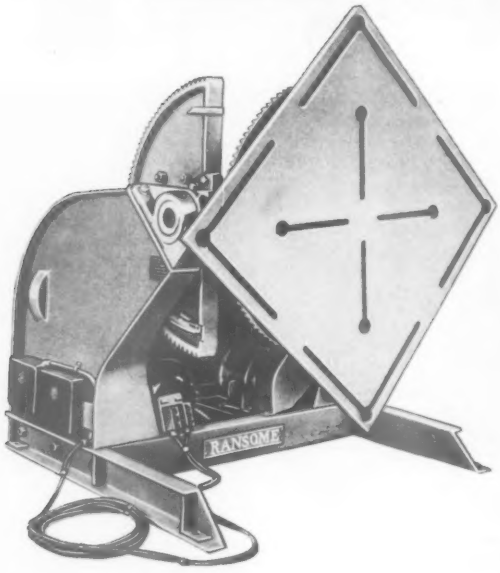
Specifications are as follows: Model 1000 WV or WH, 110 volts a-c, 9 amps; Model 2000 WV or WH, 220 volts a-c, 10 amps, equipped with water-cooled electrode holders. Dimensions: 10-in long, 11-in. deep and 10-in. high. Control box is 4-in. high.

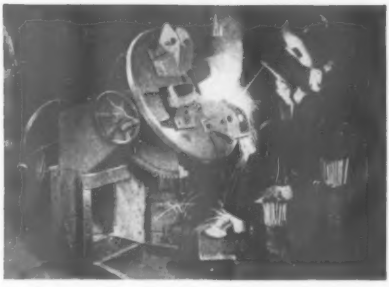
JOVAL PRODUCTS, INC., 56 Belmont Ave., Newark 3, N. J.

(More New Products on Page 85)

Lots of Different Pieces or Lots Alike...

THIS POSITIONER PAYS OFF





in more production . . . better welds . . . less rod waste

The universal table top makes the Worthington-Ransome Welding Positioner as profitable on *job* work as it is in mass production.

Those "T" slots make the table adaptable to any shape of work piece and a wide range of sizes. No special jigs or fixtures needed.

Whether you produce "thousands alike" or "every one different", benefit from *increased arc-time* with Worthington-Ransome Welding Positioners. With just one set-up, the work is clamped to the table top. Then push-button controls or simple hand cranks do the work of tilting or rotating into any position convenient for economical downhand welding. Your welder can continuously weld without costly time and labor wasted in frequent rehandling of the work.

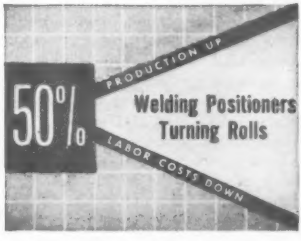
Result—up to 50% more footage, *better* welds (using higher current and heavier rods), less welding rod waste.

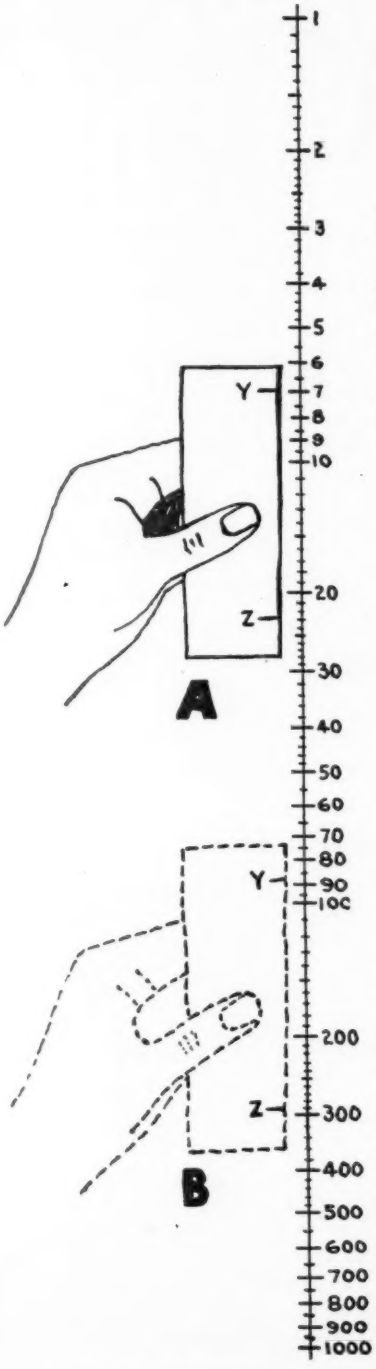
Welding positioner capacities from 100 lb to 30 tons. Also: turning rolls from 3 to 150 tons, stationary or self-propelled.

Write Worthington Pump and Machinery Corporation, Dunellen, New Jersey, for bulletins or additional information.

Y.1.2

WORTHINGTON





To Solve Your Ratio Problems

BY W. F. SCHAPHORST, M. E.

RATIOS are involved in so many, many aspects of our daily life that we are not always aware when we meet one. The tip-off to indicate a ratio will be found in the little words "to," "per" and "to the." Percentage, for instance, is always a ratio—so many of something per hundred units. You are also talking ratios whenever you speak of your car's mileage (gallons of gasoline consumed per mile) or speed (miles per hour).

In the welding shop, there are many different kinds of ratios that you may be using all the time in your daily problems. Here are a few examples culled from previous Engineering Data Sheets:

Tensile strength—pounds per square inch.

Yield strength—pounds per square inch.

Elongation in 2 in., per cent.

Reduction of area, per cent.

Cubic feet of flow per minute.

Lb of cable, wire or hose per foot of length.

Weights of sheets and plates per sq ft for a given thickness.

Duty cycle—percentage of time per hour that a welding machine is actually engaged in welding.

Oxygen or acetylene consumption—cu ft per hour or per linear foot of welding or cutting.

Travel speed—inches per minute.

Filler metal deposited per lb of electrode.

Spatter, coating and rod end loss per lb of electrode.

Lb of weld metal deposited to a given thickness per sq in. of surface.

Cost of weld metal—per lb of electrode or per sq in.

Amount of weld metal required (lb per ft) per size of fillet weld in inches.

Permissible loads for fillet welds per inch of length.

Any welding shop problem that involves ratios can be solved easily and quickly with the aid of the handy computing chart on the left. This chart does away with the need for pencil figuring and is applicable to a surprisingly wide variety of situations.

To get the ratio you want, slide a slip of paper against the scale and mark on it the two terms of the ratio. The distance between your two marks will always be the same ratio as measured on the scale.

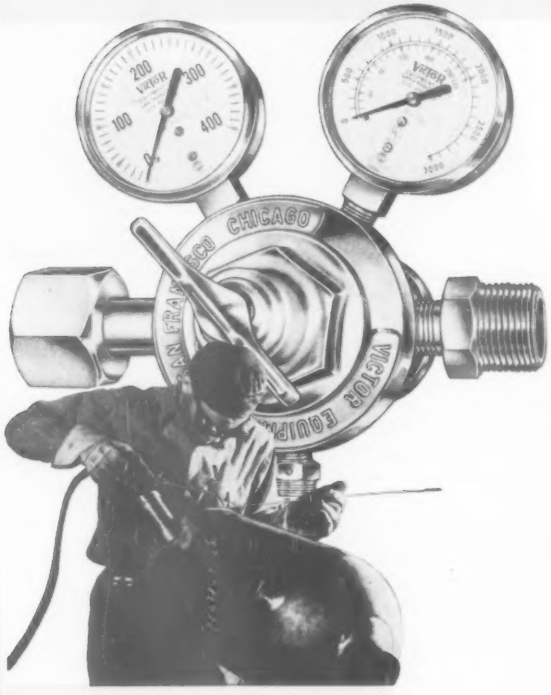
Example: One shaft of a given drive is to run at 88 rpm and the other shaft is to run at 290 rpm. Make marks Y and Z on the slip of paper at position B opposite the 88 and 290 points. Whether you move the slip upward or downward, the ratio between marks Y and Z will always be 88 to 290.

Now say that you have a 7-in. pulley suitable for the 290 rpm shaft, what would be the diameter of the pulley needed for the 88 rpm shaft? All you have to do to solve this is to bring the Y-mark opposite the 7 as in position A. The Z-mark then says that the other pulley must be 23 in. in diameter.

Of course, you can add ciphers to the figures on the scale where necessary. Just add them mentally as you go along. Thus if the speeds were 880 and 2,900 rpm, position B applies in exactly the same way and you would still get 7 in. and 23 in. in position A. But remember this: when you add a cipher to one, you must also add a cipher to the other.

For Better Work at Less Cost!

STANDARDIZE ON VICTOR

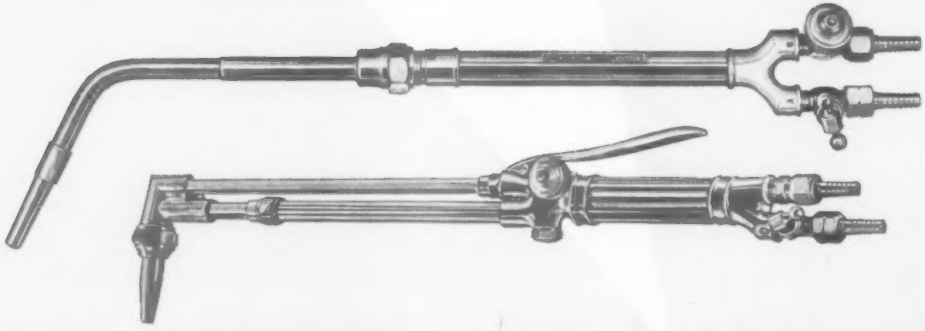


SAFETY REGULATORS for almost every gas and use—pressures up to 5,000 PSI.

WELDING TORCHES for light gauge to heavy castings. Interchangeable nozzles and extensions available for descaling, multi-flame heating and other special purposes.

CUTTING TORCHES and attachments for thicknesses from light sheet to heavy billets.

With Victor's precision-built apparatus you can custom build your welding and cutting outfit to fit your exact needs . . . then expand it as your business grows. See your Victor dealer TODAY.



VICTOR EQUIPMENT COMPANY

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For Your Technical Library—
Free Catalogs • Booklets • Bulletins

A Welding Engineer Reader Service

1 CREAM SOLDER—Wayne Chemical Products Co., Detroit 17. 6-page, two-color folder describes "Multisolde" cream solder. Directions tell how it is brushed on a joint and then heated with a torch to form a strong bond without any cleaning or cleaning. See page 85.

2 MEASURES WELDING HOSE—Olympic Instrument Laboratories, Cove, Wash. 4-page, two-color bulletin tells about the Olympic Wire and cordage meter No. XD for measuring welding cable and single or double welding hose. Accessories, attachments and stands for the meter and counter are also pictured and described. See page 85.

3 BRONZE WELDING ROD—Eutectic Welding Alloys Corp., Flushing, N. Y. Leaflet 448P contains complete specifications and data on "Eutectrod 148FC," a new bronze welding rod for cast and malleable iron welds.

4 METALLIZING MAINTENANCE—Metallizing Engineering Co., Inc., Long Island City 1, N. Y. 6-page publication tells about metallizing oil pump rods, compressor crankshafts, cooling drums, axle housings, pistons, steel tire molds and pins. There is also a discussion of a new molybdenum metallizing wire.

5 ARC-AIR GOUGING TORCH—Arcair Co., Bremerton, Wash. Single sheet bulletin illustrates and describes the new "Arcair" compressed air and electric arc operated gouging torch for shipyards, pipeline crews, fabricating shops and construction sites. See page 66.

6 BRONZE ROD QUALITY—Titan Metal Mfg. Co., Bellefonte, Pa. 8-page, two-color booklet tells about the use of a direct-reading spectrometer to check the quality of the brass and bronze going into welding rods. Other control methods to watching the quality of brass are also described.

7 SAFETY VALVE—Ross Operating Valve Co., Detroit 3. 4-page bulletin 504 tells about the Ross safety valve that has no spring or clapper type solenoid to create new highs in operator protection around presses, welders, etc.

8 SILVER BRAZING—Handy & Harman, New York City 38. 4-page, two-color bulletin No. 54 tells about rings and other preformed shapes of silver brazing alloy for various production jobs. Applications shown are heating elements for water heaters, insecticide bombs, gas meters, etc.

9 A-C INERT-ARC WELDER—Miller Electric Mfg. Co., Appleton, Wis. New folder describes the Miller line of a-c arc welders for all applications of Linde's Heliarc process with charts, specifications and recommendations for automatic control panels and the special spot welder.

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10 POWER-FACTOR METER—General Electric Co., Schenectady 5, N. Y. 16-page Bulletin GEA-5469 describes and tells how to use a new bench-on power factor meter that permits direct reading without cutting conductors or interrupting service. Photos and diagram clearly explain its applications.

11 WELDING TUBING STEELS—The Babcock & Wilcox Tube Co., Beaver Falls, Pa. Technical bulletin 122 tells about the design, fabrication and use of steel tubing for high temperature and high pressure applications. It also has information on physical properties, creep strength, oxidation resistance, etc. of 14 more popular steel tubing types.

12 HOLD-DOWN CLAMPS—Carroll & Shipley, Inc., Anderson, Ind. 4-page bulletin and separate price and specification brochure tell about the C and S safety clamps for holding down dies, castings, machined parts, weldments, etc., to exact tolerances with great rigidity. Large diagrams illustrate their action and applications.

13 A-C ARC WELDERS—Precision Welder Mfg. Co., Chicago 10. 4-page bulletin in two colors, plus price sheet, tells about 7 models of transformer arc welders ranging in capacity from 30 to 300 amps. Recommendations for use of each as a hobby unit, farm repair tool or industrial welder are listed and all other specifications tabulated. See page 86.

14 AIR-OPERATED GRINDER—The Ester Tool Co., Cleveland 12. 4-page Bulletin No. 58 gives a comprehensive review of the Ester line of grinders, chippers, drills, sanders, gunmers, nut setters, screw drivers and sealers. Most tools are pictured and there are excellent diagrams and tables explaining each type of operation and application.

15 CAST WELD CONSTRUCTION—Steel Founders Society of America, Cleveland 15. Booklet gives data on new developments in cast-weld construction, saving metals conservation, production economies, functional design, etc. It includes 16 illustrations and 9 pages of text explaining basic principles.

16 CHECK R-W SCHEDULES—Instrument Div., Brush Development Co., Cleveland. Bulletin Vol. IV, No. 5, tells use of Brush instruments to calibrate and adjust each spot welder before it is shipped by a major resistance welding manufacturer. It is written for both the experienced and inexperienced spot welding engineer and contains block diagrams and sample charts available.

17 CONTACT WELDING—R. I. Mendels, Inc., New York City 17. 16-page instruction manual explains the principles and operating characteristics of contact welding electrodes (those having metal coatings that conduct current, so they can be dragged along the joint). Several tables are included showing plate thickness, number of passes, type of electrode, welding current, length of weld per electrode in., etc.

18 AIR-GAS TORCHES—Weldit, Inc., Detroit 6. 4-page bulletin in two colors describes three models of air-gas torches, one model of propane and air paint burner as well as other accessories and equipment for welding and soldering. Prices for tips, hose, torches and parts are listed.

19 GRINDING WHEEL BOND—Chicago Wheel & Mfg. Co., Chicago 7. 4-page, pocket-size folder gives details on applications and advantages of using "XL" bonded wheels for tungsten carbide tool grinding and other grinding duties. It gives specs for straight and cup wheel sizes for rough and finish grinding.

20 WELDING SPEED STEELS—W. J. Holliday & Co., Hammond, Ind. 4-page Bulletin 907 gives complete discussion of welding "Speed Case," "Speed Tru," and "Speed Alloy" sulphur bearing steels. Various electrode types are recommended and a table on the last page lists manufacturers making suitable electrodes and the applications and current ratings for each.

21 WETTING AGENT—The Aquadyne Corp., New York City 17. 8-page pocket-size folder tells about the "Aquadyne" system for producing "wet" water for cooling resistance welders, machine tools, fire fighting, washing and cleaning, etc. Chemicals and apparatus needed are explained.

22 SPATTER PREVENTIVE—Wayne Chemical Products Co., Detroit 17. 4-page booklet gives listings and short descriptions of the Wayne line of welding spatter and flash preventives, soldering fluxes and cleaning compounds.

23 HEAT TREATING FURNACES—Heat Duty Electric Co., Milwaukee 1. 8-page bulletin IND-453 tells about pit-type convection furnaces for tempering, drawing, annealing and hardening steel as well as non-ferrous annealing and solution and aging treatments. Pictures show furnaces in use in aircraft factories, munitions plants, etc.

24 BARREL FINISHING—Minnesota Mining and Manufacturing Co., St. Paul 5, Minn. 12-page, two-color booklet tells what barrel finishing is, who can use it and what advantages it offers to makers of machined parts, stampings, forgings and castings.

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We Mobilize for Freedom

CONTROLS . . . A Two-Edged Sword

It may seem dangerously premature to talk about getting rid of emergency government controls while all-out war is still an imminent possibility.

But success in this strange struggle for our freedom into which the Russian Communists have plunged us requires that we:

1. Maintain a whole battery of controls designed to speed defense production and curb inflation, and at the same time

2. Work to end the controls at the earliest possible moment.

Here is the reason why this editorial—fourth in a special series on mobilization for defense—is devoted to the need for a speedy release from controls.

If the Russian Communists can force us to maintain indefinitely the present system of government controls, they will have won a tremendous victory. They will have saddled us with a system of collectivism which, over a period of years, would be fairly certain death to freedom of business enterprise.

Make no mistake about it. This is not an argument against emergency controls. We need controls now to break a right of way for our mobilization program through the business boom. Indeed, the third editorial in this special series was titled "Why Controls Are Necessary." It stressed both the need for controls and the need for positive cooperation to make them work.

Controls Can Undermine Our Economy

But these controls surely chisel at the foundation of our normal economic system. So long as we have them, many if not most key business decisions will be made in Washington bureaus rather than in the free market place. For example, the *National Production Authority* administers a *Controlled* Materials Plan (italics ours) which directs the flow of basic metals, and decides who can use them for what purposes.

Happily, the people who operate these controls are not using the methods of a secret police state.

Even more happily, most of the leaders who have been drafted to manage the controls are not in love with their jobs. They are doing their best in the thankless task of making controls work. They recognize the danger of chronic controls.

But the fact remains that our economy is

operating under arrangements which carry it a long way toward the pattern of centralized control the Russians would inflict on the world.

The Wilson Plan

A plan for getting rid of these controls has already been developed. It was put together by our Director of Mobilization, Charles E. Wilson—while he was working day and night to set up the necessary emergency controls.

The Wilson Plan—if we escape all-out war—will strengthen our defenses and our economy. By 1953, it calls for:

1. Providing the weapons to equip an armed force of 3½ to 4 million, together with a supply of weapons for our allies.

2. Building a stockpile of weapons which, with current production, would be sufficient to carry on an all-out war for a year.

3. Building the manufacturing capacity by which we could rapidly expand our production of weapons if all-out war should come.

4. Increasing the productive capacity of industry enough to resume the expansion of our civilian economy.

With these jobs done our economy would be big enough and strong enough to meet both civilian and military requirements. And the government controls needed for mobilization could be speedily dropped.

Call for Sacrifice

The Wilson Plan requires a major effort—it means spending more than $50 billion a year for mobilization. That is almost 20 percent of our total production. And this cannot be done without sacrifice. For a time, particularly in the next year, living standards will drop.

But the sacrifice required is amazingly small. At the peak of the defense effort, civilians will still have available to meet their needs about as much as they did in any year before 1948.

To make the Wilson Plan succeed we must curb inflation. A second year of inflation such as that which we have had since the Korean war started would multiply disastrously the costs of our defense program. One key part of a successful program to curb inflationary pressure, which soon will be building up again, is a pay-as-we-go tax program. The second editorial in this series urged that we do our utmost to pay as we go.

We Cannot Out-Control the Communists

But, above all, to make the Wilson Plan work we must keep our sights set on the crucial importance of increased production. Our problem is to increase our capacity to produce so that we can carry both a major military program and an expanding civilian economy for as many years—General Bradley thinks it might be fifteen or twenty—as the menace of Russian Communist aggression persists.

If we do not produce enough to do this double job, we shall be confronted with the prospect of having to live indefinitely under government controls of the sort that have been set up since the start of the Korean war. That would be delightful to the Russian Communists. It would go far toward making over our economy on the Moscow model.

Even if we wanted to, we never could hope to out-control the Russians. They are miles ahead of us in that line. But we can out-produce them, by a tremendous margin. By doing that we shall travel the surest road to victory.

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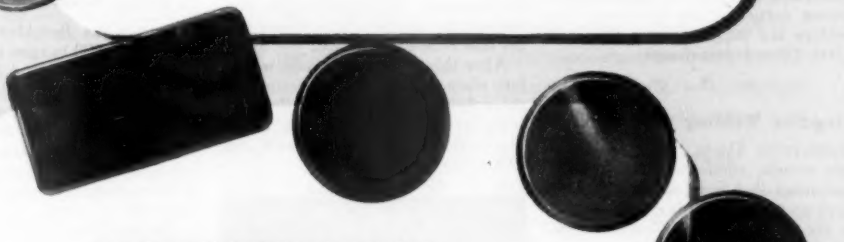

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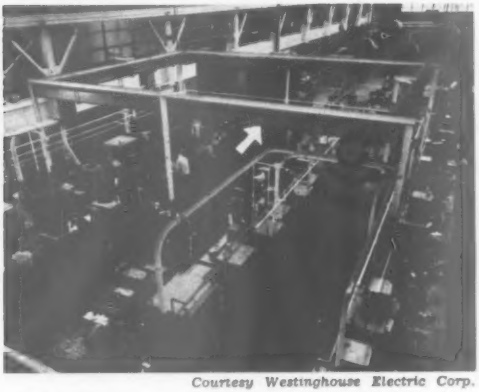
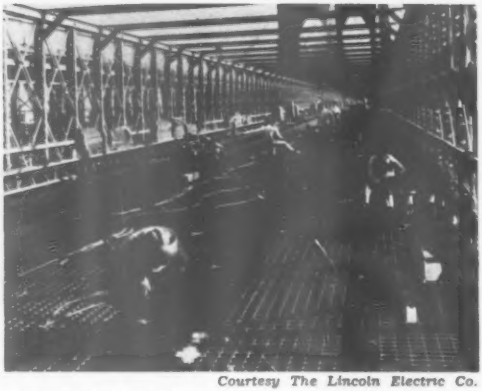


Courtesy Westinghouse Electric Corp.

BUS LOOP (top of picture) feeds 18 resistance-welding machines. Note tap boxes at lower corners of loop



Courtesy The Lincoln Electric Co.

BROOKLYN BRIDGE is being brought up to date with 205,500 sq ft of welded grating for concrete roadway

Feed for Resistance Welders

VOLTAGE DROP is reduced to a minimum by a 1,500-amp bus loop that feeds 18 resistance welders at the Beaver Works of the Westinghouse Electric Corp., Beaver, Pa. The individual resistance welders vary in capacity from 10 to 75 kva. Wiring is greatly simplified since the welder-supply cable for a group of welders runs from a tap box located at the nearest corner of the bus loop. The welders are supplied by a 428-kva, 2,300/230-volt transformer.

* * *

King-Size Welding

FABRICATING 5½-in. plate into pressure vessels, condensers and related equipment that must withstand pressures up to 7,000 psi is no small task. In the manufacture of such heavy-duty equipment, welding plays a major role at the Cartaret, N. J., plant of the Foster-Wheeler Corp.

Shells of less heavy material are roll formed in the conventional manner. For very heavy sections, however, flat plate is heated in a furnace and then formed hot in a nearby hydraulic press. Sections as thick as 5½ in. have been formed by this method, and a press capable of handling even larger sections will be installed soon. A flame-cutting tractor is used to bevel the edges of the heavy sections for welding.

The formed sections are tack welded manually, and then seam welded by the submerged-arc process. On heavier sections, the first pass is hand welded in a jig. The submerged-arc automatic head travels on an overhead track that is adjustable in height to accommodate sections of different diameters. The submerged-arc machine can be used to make both exterior and interior welds.

The accompanying picture was especially posed to show the depth (3½ in.) of a weld to be made to add a head to one of Foster-Wheeler's heavy-duty vessels. In his left hand, the operator holds the switch controlling the electric-motor-driven rollers that rotate the section.

After this head is manually welded into place, the automatic welding machine finish welds the circumferential seam by depositing multiple beads. The section is turned at a steady rate to provide even layers.

Courtesy General Electric Co.

DEEP WELD (3½ in.) is made to join head of heavy-duty pressure vessel to the shell. Weld will be finished by submerged-arc process

As a final stage in manufacture, fillet welds are made to join the nozzles to the head of the pressure vessel. Welding transformers, located out of the way along the walls of the shop, furnish power for manual and automatic welding operations and for tack welding.

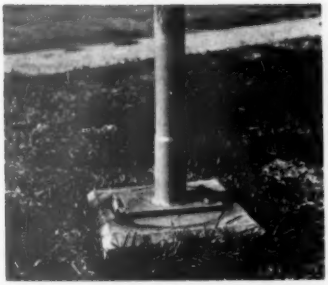
* * *

A Bridge Grows in Brooklyn

THE FAMOUS Brooklyn Bridge was started in 1883 to span the East River between Brooklyn and Manhattan. It took 14 years to construct and was long considered to be a major engineering miracle. Now the old wooden block roadways and the trolley tracks are being torn out to allow the bridge to be widened for ever increasing motor traffic.

The bridge will go back into service with a new look and two new roadways to accommodate six lanes of traffic. The south roadway has been completed at the present writing, while the north roadway is under construction. Each roadway is being widened from 16 ft to 30 ft 11 in., a feat made possible by the removal of the streetcar tracks on the side of the roadway.

After new stringers were welded in place, a 3-in. I-beam lock grating was put down to be filled with concrete. The 205,500 sq ft of grating were welded with 3/16-in. E-6010 electrodes, using 20 portable gas-engine-driven 300-amp welders. The J. K. Welding Co., of Brooklyn, did the work on a subcontract for the general contractor, the Klevens Corp.



HINGED BASE makes it safer to put up or lay down this flagpole. Pole fits into 3½-in. pipe sleeve

Hinged Flagpole

By Elton Sterrett

THE WELDOR who fabricated the 40-ft steel mast glimpsed in the above picture greatly simplified erection and subsequent servicing by attaching a welded hinge to the base. The flagpole was made by welding 3-in., 2½-in. and 2-in. pipes together. A sleeve of 3½-in. pipe was used to hold the bottom of the pole.

The short section of 3½-in. pipe was welded in the center of a rectangular plate. This is known as the upper hinge plate since one edge of it was formed into half of the hinge. A second plate served as the lower half of the hinge. The lower plate was fitted with downward projecting lugs that were embedded in the concrete base at the time the concrete was cast.

Opposite the hinge side of the upper plate, two ⅞-in. holes were drilled. These fitted over two ¾-in. studs welded to the lower hinge plate. Nuts on the studs secure the upper plate firmly to the lower.

The hinge pin was put in while the pole was horizontal. When the pole was raised, the hinge held the base in line and greatly simplified the job of setting up the 40-ft steel flagstaff. When the pole has to be lowered for repainting or other maintenance work, the two retaining nuts on the studs are removed to permit the upper hinge plate to be raised. The pole is then lowered to a horizontal position without the hazards that would attend lifting a bolted pole from its base and laying it down.

* * *

Steel Saver

BY CONVERTING from a casting to welded steel, the J. H. Day Co., of Cincinnati, was able to make a plate hook out of scrap. In addition, labor and machining time were saved by eliminating punching, drilling and riveting or bolting.

PAGE *Stainless Steel*

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AC or DC . . . the BEST
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GB's line of six standard silver solders offers a range which meets standard production methods. When special solders are required, GB's Technical Service Division offers assistance which is based on experience in alloying and refining precious metals that goes back more than 80 years.

GB Standard Silver Solders

GB No. 50	Silver Solder, melting range	1160-1175°F
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GB No. 45	Silver Solder, melting range	1125-1145°F
GB No. 41	Silver Solder, melting range	1125-1160°F
GB No. 35	Silver Solder, melting range	1130-1270°F
GB No. 31	Silver Solder, melting range	1130-1300°F

GB FLUXES

The physical properties and appearance of a brazed joint are controlled to a large degree by the flux which is used. For this reason it will pay you to team-up GB Flux with GB Silver Solder — they were developed to produce maximum results when used together.

GB DATA BOOK

Here's real factual data on all of the important phases of low temperature brazing. You can get a free copy from your GB Distributor — Write us and a copy will be forwarded to you.

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PIPE FABRICATION

(Continued from page 25)

vent the oxygen stream from reaching the iron; their removal allows the cutting to proceed. The powder-cutting method is applicable to any thickness of material; we have successfully cut billets 12 in. thick by this process.

Another special application of the cutting torch is for stack cutting. The plates or sheets to be cut are first securely clamped together to form a "stack" 3 to 4 in. thick. Stack cutting is used where identical shapes must be cut in large quantities.

Although not a special application, the cutting of material less than $\frac{3}{16}$ in. thick requires techniques entirely different from those previously described. Basically, a leading angle is applied to the torch tip. Clean square cuts can be made at relatively high speeds if proper tips are used with accurately controlled cutting-oxygen pressure and preheat flame.

Another unusual application of the oxyacetylene heating torch is for the low-temperature stress relieving of welds. Two multiflame torches followed by a spray of coolant water are moved along on either side of the weld that is to be stress relieved. By moving the assembly at proper speed relative to the thickness, this application of heating and cooling can have the effect of plastically deforming the weld and thus mechanically stress relieving the weld area. The operation is pictured in Fig. 4, where a "roundabout" weld on 53-in. diameter pipe of $\frac{7}{16}$-in. wall thickness is being stress relieved.

It should now be apparent why pipe fabricators pay tribute to the oxyacetylene processes. The type of work that can be performed, the number of combinations of equipment possible, the ease of control, the quality of the product and the relatively low initial cost are all big advantages in pipe fabrication.

Large Fabricated Assemblies

Figures 5 to 9 illustrate jobs in which fabrication was aided by the oxyacetylene processes we have just described. Figure 5 is a 22-in. header for the river crossing on a gas transmission line. The reinforcing pads and gussets were torch cut from plate,

and the pipe sections were fabricated with the help of the oxyacetylene processes.

The big Y's in Fig. 6 were for use on an Iranian loading dock of the Trans-Arabian Pipe Line Co. Main leg is 30-in. pipe of 5/16-in. wall thickness; branch outlets are 16 in. with 1/2-in. wall thickness. Manual and machine cutting, gouging and heating torches were all used to produce these complicated assemblies.

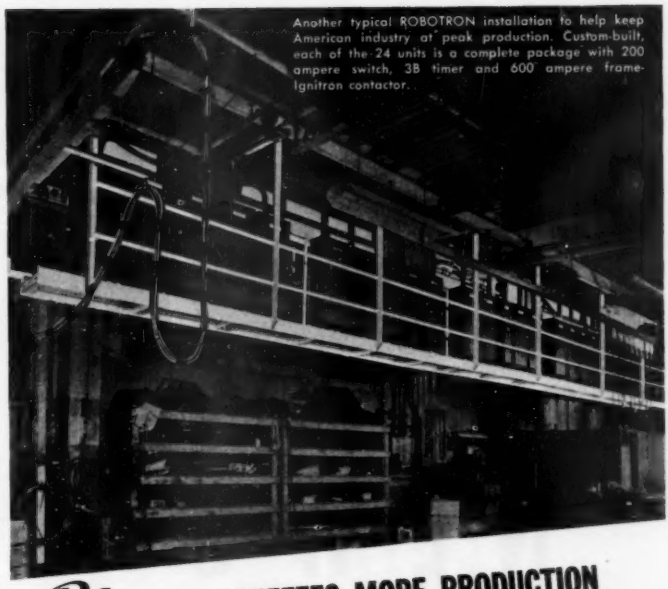
Figure 7 is a basket strainer with 24-in. outlets that was fabricated from 1 1/4-in. plate for the loading end of the Trans-Arabian pipe line. The interior contains a screen that is mounted on skids made by surface brazing of the skid angles. This pipe structure was tested at 1,500 psi.

The very peculiar looking assembly shown in Fig. 8 is part of a fabricated water syphon inlet for the City of Caracas in Venezuela. Eight such pieces are put together to form a "pie" in a large tower. Rectangular opening on left is approximately 7 by 15 ft; trapezoidal section on right 4 by 11 ft. The section was fabricated from 1/2-in. plate, angles and channels.

The lead condenser in Fig. 9 was fabricated from sections of corrugated furnace pipe, smooth-turn fabricated elbows and special outlets. The diameter of the main structure is approximately 36 in.

These varied applications well illustrate the versatility of the oxyacetylene processes, which are readily adaptable to any conditions in the shop or in the field. However, the equipment must be used with proper engineering control, and the operators must have a good working knowledge of it. Poor quality work is generally the fault of misused equipment or lack of operating know-how.

"Just run a quick pass around so we won't have to stop it and slow down production."



Another typical ROBOTRON installation to help keep American industry at peak production. Custom-built, each of the 24 units is a complete package with 200 ampere switch, 3B timer and 600 ampere frame-Ignitron contactor.

Robotron SQUEEZES MORE PRODUCTION FROM MAJOR AUTOMOTIVE WELDING LINES.....

To an industry, world renowned for its progressiveness, ROBOTRON electronic control systems have proven to be a dependable factor in better production line assembly. Size of installation, illustrated above, is a good example of one manufacturers confidence in ROBOTRON'S ability to deliver higher production, more accurately, with less maintenance and costly down-time. Centrally located, this compact overhead island of welding timers, with catwalk high over production line, also features overhead power lines which drop directly to a large bank of nearby welding transformers and welding guns. Best of all, with ROBOTRON quick interchangeable "Brain" and "Power" panels, Spot and Pulsation welding machines can utilize same basic welding timer-control from operation to operation. Easy to install, replace or service, all functional elements are simply and sturdily built for hard use and long life.

If welding production is a factor in your manufacturing defense or civilian products, ROBOTRON engineers are anxious to demonstrate or advise on similar installations geared to your specific needs.

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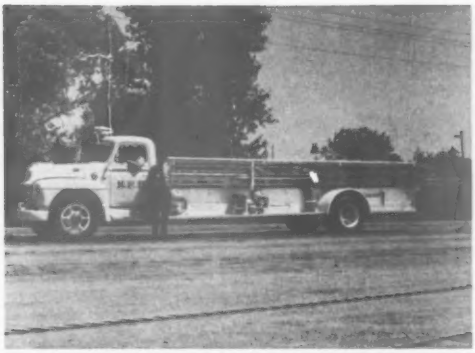


WELDED FIRE TRUCK built by Norfolk, Nebraska, firemen saved city $4,000. Fire chief R. H. Wolff stands by the cab. More than 140 lb of electrodes were used

Photo courtesy Burger Boat Co. and Chase Chemical Corp.

COOL sight on a warm August day, the *Polaris* shows off her finely shaped welded hull. Welded seams are corrosion-protected by a new cold galvanization compound

NEWS

NPA Committee For Welded Tubing

NATIONAL Production Authority, U. S. Department of Commerce, has announced the personnel of an eleven-man advisory committee for the welded and seamless tubing industry. The following members will serve:

W. J. Thomas, Babcock & Wilcox Tube Co., Beaver Falls, Pa.; F. W. Sexauer, Brainard Steel Corp., Warren, O.; Walter Wiewell, Crucible Steel Corp., Pittsburgh; Lee Mullen, Globe Steel Tube Co., Milwaukee; Aaron Waines, Ohio Seamless Tube Co., Shelby, O.; B. R. Mueller, Pittsburgh Steel Co., Pittsburgh; J. A. Ireland, Republic Steel Corp., Cleveland; S. L. Willis, Standard Tube Co., Detroit; R. H. Gabel, Superior Tube Co., Norristown, Pa.; W. E. Taggart, Timkin Roller Bearing Co., Canton, O., and H. L. Bialock, National Tube Co., Gary, Ind.

* * *

Nebraska Firemen Build Own Welded Fire Truck

CONSIDERABLE interest among volunteer firemen over the country has been aroused by a welded hook-and-ladder fire truck built by the men of the Norfolk Fire Department, Norfolk, Nebraska. Purchasing only the motor and chassis, the town's 12 paid firemen and 75 volunteers contributed their time over a 3 months period to weld the rest of the frame and accessories. Welding proceeded under the direction of Fire Chief R. H. Wolff, who has done considerable welding in auto repair. Savings for the City of Norfolk over the cost of a completely outfitted truck were figured at more than $4,000.

All welding was performed in a local garage equipped with a 300 amp d-c arc welder. Among equipment that had to be mounted was a 1,250 watt emergency lighting plant and several floodlights and spotlights. Compartments for hose, fire axes, smoke masks, chemicals, etc., were welded from 1/16-in. thick steel sheet. Running boards were made from ⅛-in. steel sheet. Braces for the frame were made from 2-in. angle sections flame cut to size and welded. Part of the roller mechanism that supports the long ladders was fabricated from 2½-in. wide by ¾-in. thick steel plate. Altogether more than 1,000 in. of welded seams were deposited. Some 140 lb of electrodes were consumed.

Pictures and descriptions of the truck have appeared in numerous firemen's association publications and newspapers in Los Angeles, Denver, Minneapolis, Des Moines, Sioux City and Omaha.

* * *

World Metallurgical Congress To Feature 1951 Metal Show

FIRST of its kind ever held, a World Metallurgical Congress will be going on concurrently with the 33rd Metal Show, Oct. 14-19 in Detroit. More than 500 conferees from 20 countries are expected for the event. The Metal Show, more correctly titled the National Metal Congress and Exposition, is sponsored by the American Society for Metals.

The foreign visitors are expected to arrive in this country about Sept. 15. For four weeks they will travel in one or another of eight groups making study tours to industrial, government and educational institutions all over the country.

Dr. Zay Jeffries, Pittsfield, Mass., retired vice-president of the General Electric Co., has been appointed director general of the metallurgical congress.

For information concerning either the Metal Show or the World Metallurgical Congress, you can write to William H. Eisenman, Secretary, American Society for Metals, 7301 Euclid Ave., Cleveland.

* * *

8-In. Aluminum Pipeline Passes 1½ Year Burial Test

RECENT uncovering of a 40-ft bare aluminum bypass installed 17 months ago in the Alabama-Tennessee Natural Gas Company's 8-in. welded aluminum pipeline revealed no discoloration or corrosion. This section of pipe was installed with special bypass valves so that it could be dug up at intervals without disturbing the operation of the main pipeline which serves Reynolds Metals Company's Listerhill, Ala., plant. (See THE WELDING ENGINEER, July, 1950, page 27.)

The test was supervised by the officials of the Alabama-Tennessee Natural Gas Company and representatives of Reynolds. Soil analyses were taken along the test section and are available upon request to W. B. Moore, Reynolds Metals Co., 2500 South Third St., Louisville, Ky.

YOU CAN BE **SURE**.. IF IT'S
Westinghouse

NEW D-C WELDER
ELIMINATES NOISY MOTOR GENERATOR!

★ **SELENIUM RECTIFIER ENDS WELDER NOISE...** No noisy, inefficient rotating parts.

★ **SIMPLICITY SLASHES OPERATING COSTS!** Only 3 basic elements... transformer, reactor and rectifier. No motor-generator maintenance expense. Savings in space and weight mean easier moving on the job.

★ **SMOOTHER WELDING...** Less arc blow...: easier arc striking... better weld quality.

★ **SAVES $126 A YEAR IN POWER COSTS ALONE!** No-load loss of only 500 watts, compared to 2480-3600 on a conventional motor-generator welder.

FREE TRIAL!

We'll arrange DEMONSTRATION OR TRIAL INSTALLATION, and at no cost to you. Contact nearest distributor, or write Westinghouse Electric Corporation, Dept. DC61, P. O. Box 868, Pittsburgh 30, Pa.

J-21594

Westinghouse
D-C Welders

Pandjiris Saves 3 ways with Ampco-Trode*

. . . here's how "bronze-facing" with Ampco Electrodes helps cut manufacturing costs on Hydramatic Tube and Pipe Bender

This machine, fully automatic, bends pipe up to 4-inch diameter with 12-gauge wall. The bending head must withstand high working pressures and resist wear. That's why Pandjiris Weldment Co., St. Louis, "bronze-faces" several vital working parts with Ampco-Trode* — Ampco Bronze Electrodes.

The wear-resistant Ampco-Trode 200 overlay provides a good bearing surface, reduces friction and increases service life.

But that's not all—it eliminates the need for castings and 3 costly machining operations.

You, too, can save with Ampco Bronze Electrodes. Get a supply today and let their wear-resistant qualities help you cut both manufacturing and maintenance costs.

(Above) Tube and Pipe-bending machine manufactured by Pandjiris Weldment Co.

(Left) Gibs on slide block forming dies are "bronze-faced" with Ampco-Trode

Ampco Metal, Inc.

Milwaukee 46, Wis.

West Coast Plant: Burbank, California

W-115

It's Production-Wise to Ampco-ize!

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

EASTERN manager for *The Welding Engineer* is Frank P. Di Toro

Frank Di Toro Joins *Welding Engineer* Staff

NEWEST addition to the advertising staff of THE WELDING ENGINEER is Frank P. Di Toro. He will be eastern manager, with headquarters in the McGraw-Hill building at 330 West 42nd St., New York City 18.

Mr. Di Toro comes to us from *Barron's Magazine* where he was an advertising salesman. Prior to that he worked for The Dictaphone Corporation.

During the war Mr. Di Toro served 38 months in the Army Air Force as a weather observer. This duty included extremes as far as stations go—for a year he taught weather cadets at New York University, close to home and family. Reconsidering, the army sent him to an isolated 4-man weather station on the Alcan Highway in the wilderness of the Yukon territory of Canada.

Before the war, Mr. Di Toro went to college at Pace College and City College of New York. He is married and has two children.

* * *

Second Bridge Span Falls 100 Ft into Water

ONE thousand tons of steel framework, 70 ft high and 518 ft long, raised a terrific splash in the Ohio River on June 7 when it plunged from a height of 100 ft. This was the second such dunking in that spot for a bridge span (see January issue of THE WELDING ENGINEER, page 56).

Reason: the 62-year-old Illinois Central Railroad bridge near Cairo, Ill., is being replaced piecemeal. As each new span of the 7,865-ft bridge is finished and moved into place, the old one hits the drink. The old spans will not rest permanently on the river bottom, however, but will be removed and cut up for scrap. Length of the bridge is 7,865 ft.

THE ARC-FIT PROCESS Patented

Tube notched with special ARC-FIT
Angular notch on tubular member.
Square tube notched to fit square pipe.
Angle joint on two pipes.
"T" notch on end of Tubular member.
Pipe Notched with deep slot.
"T" joint on tube or pipe.
Angle iron notched to fit pipe.

TOPS IN SHOP EFFICIENCY

5 seconds to notch Tubing and Pipe Ends

The answer to many problems confronting large and small shop owners. No shop can afford to be without the ARC-FIT—no matter how large or how small. Manual or power operated—fits the ARC-FIT hand press or any standard power press.

ARC-FIT is a patented precision-built shearing tool which prepares the ends of tubing or pipe to produce welded or brazed tubular "T" or angle joints. ARC-FIT will not deform the tube or pipe and no further finishing is required—no sawing, cutting, or removing sections with milling cutters. Our literature gives many fine points on operation, construction, and application—send for it today —also write for quotations.

VOGEL TOOL & DIE CORPORATION

1825 N. 32ND STREET
Dept. W-E
MELROSE PARK, ILL.

2 NEW AO PRODUCTS

For Better Welding See-Ability!

COVER LENSES
and
COVER PLATES

NEW PLASTIC COVER LENSES

Give Longer Life . . . Reduce Fogging

Here's AO's latest in protecting filter lenses from spatter in welding and burning operations. Made of thin cellulose, center portion of lens is raised to permit a space between it and the filter lens — thus a fiber washer is not needed to separate the lenses. RESULT: THIS AIR SPACE BETWEEN LENSES CREATES A NEAR VACUUM THAT AUTOMATICALLY *REDUCES FOGGING TO A MINIMUM.*

The No. 162 LASTS LONGER, too — won't break when dropped — won't crack because shock-absorbing acetate cushions the blow.

QUICK FACTS

- Sparks bounce off without damage.
- Resists fusion of hot metals—deflects spatter.
- Remains pit-free longer than glass.
- Clear acetate allows clear vision.

NEW PLASTIC COVER PLATES

Give Thrifty Protection Against Pitting and Scratching

These clear, hard plates (AO No. 168) compare in smoothness and lustre with polished plate glass. Superior resistance to abrasion makes them ideal protection against pitting by welding spatter. Long lasting — easily cleaned.

YOUR NEAREST AO SAFETY PRODUCTS REPRESENTATIVE CAN SUPPLY YOU.

QUICK FACTS

- Optically correct.
- Clear — won't discolor under ordinary welding conditions.
- Protects against eye fatigue — boosts production.
- Won't peel, blister or shrink in service.
- Highly resistant to breakage.

American Optical
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES

FOR THE FINEST IN WELDERS IT'S.... miller
AEA-200 AND AEA-200-L
SELENIUM RECTIFIER TYPE D.C. ARC WELDER
Since 1929 MILLER Welders have become the standard by which all others are judged for performance, ease of operation, maintenance cost, and increased production. MILLER Welders are designed by qualified and experienced engineers, and built in a modern plant by skilled and experienced workmen, using the finest and most up-to-date tools and equipment. To insure quality in MILLER Welders and customer satisfaction, every welder is thoroughly and completely tested before leaving the factory—and fully guaranteed.
Ask the Miller distributor in your territory for a demonstration of MILLER Welders—or write us for complete details on the type welder you need in your plant.
A.C. ARC WELDERS FOR "HELIARC" WELDING
A.C. WELDER FOR SUBMERGED ARC WELDING
MODEL 100 SERIES INDUSTRIAL WELDER
10 KVA-20 KVA PORTABLE SPOT WELDERS
MODEL BB
ARC • SPOT miller WELDERS
miller ELECTRIC MANUFACTURING CO.
SINCE 1929 APPLETON WISCONSIN

Steel, Money Saved In Welded VA Hospital

SAVINGS of 9.8% in critical structural steel and $2.66 per ton in labor costs were achieved by welding in a new 10-story Veterans Administration hospital in Minneapolis, according to *Engineering News-Record*, June 21 issue. When the building was first planned, it was to be riveted, but the medical staff protested when they heard that the new addition would involve the long, incessant din of riveting.

As a result, the VA asked the general contractor, J. D. Hedin Construction Co., Washington, D. C., and the steel fabrication and erection subcontractor, American Bridge Company, to change to welded construction. The new design provided for temporary connections for beams and columns of the clip and seat type designed by Van Rensselaer P. Saxe, consulting engineer of Baltimore, Md.

Nearly all welding work was done in the coldest winter Minneapolis had experienced for years. The temperature rose above 32 F only five working days and on 20 days it stayed below zero.

As a result, welding labor costs were higher than ordinarily—the bad weather not only necessitated heavy and cumbersome clothing but also iced up the steel to make dangerous footing. Bonus pay on Saturdays, as an incentive to endure the hardship of cold weather work, also hiked the labor cost. For 2,050 tons of steel erected, the labor was computed to be $15.78 per ton.

Despite the unusual conditions, however, there was a substantial saving in cost by welding. The estimated number of field rivets required for such a job would be 108,000. Cost per field rivet in the Minneapolis area is estimated to be $0.35 or $18.44 per ton. Estimated saving, therefore, was $2.66.

Additional cost figures for welding were worked out by R. A. Phelps, superintendent of construction on the job. A total of 14,025 lb of welding electrodes was used in 972 welder-days, or 14.5 lb per welder day. The welders averaged 29 ft of $\frac{3}{8}$ in. fillet weld (actually closer to $\frac{5}{16}$ in. size, however) per day.

Superintendent Phelps says the experience on this job will give impetus to the growing movement around the country to replace riveting by welding in structural work. Definite savings in material and labor are obtainable now and indirect savings through erection clips, non-wastage of material and in lower finishing costs will grow with the years.

WHERE TANKS ARE BUILT

ARMOR-ARC *is the accepted Electrode*

Armor-Arc B.....307 Lime Coating for AC welding
Armor-Arc C.....307 Lime Coating for DC welding
Armor-Arc MN.....307-AC-DC Coating
Armor-Arc MO.....307 AC-DC Coating

ALLOY RODS CO.

5508 W. Market Street, York, Pa.

Alloy Rods Co. YORK, PA.

WAGNER

ELECTRODE HOLDERS • GROUND CLAMPS

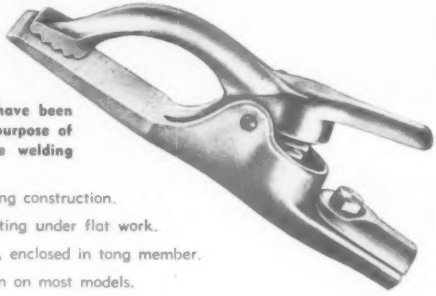
Design

THAT GIVES YOU EVERY SERVICE ADVANTAGE

Weld with Wagner

WAGNER electrode holders have been developed over a period of years to bring to the welder the long service life and cool operation necessary for economical operation.

1. High conductivity Arc-Resisting WAGNERLOY Tong Members.
2. Tough, heat resisting, high impact insulators.
3. Socket cable connection for either mechanical or soldered connection.
4. Powerful coaxial springs—adjustable tension on most models.
5. Patented channel construction for cool operation.



• Wagner ground clamps have been designed for the practical purpose of grounding the work to the welding machine.

1. Heavy WAGNERLOY tong construction.
2. Broad Flat Base for getting under flat work.
3. Powerful Coaxial spring, enclosed in tong member.
4. Adjustable spring tension on most models.

Wagner Welding Products are the result of more than thirty-three years of experience in welding and practical knowledge of mechanical and electrical engineering. WAGNERLOY, a copper alloy, was perfected by Wagner engineers to provide maximum conductivity, high arc resistance and great tensile strength.

Wagner Products ARE SOLD ONLY THROUGH WELDING SUPPLY DEALERS.

WAGNER MANUFACTURING COMPANY

350 W. 1ST SOUTH ST. JACKSON, MISSOURI

American Wheelabrator Reorganizes Sales Dept.

An expanded and reorganized sales staff has been created at American Wheelabrator & Equipment Corp., Mishawaka, Ind., according to Otto A. Pfaff, president. The firm manufactures "Wheelabrator Airless Blast" cleaning equipment used for cleaning weldments before and after welding and for other metal cleaning applications. It also makes air blast equipment, dust and fume collectors and other equipment for the metal working industries.

The addition of John A. Silver as director of sales and executive head of the sales division, brings to the company a man with 23 years experience in engineering management and the distribution, promotion and sales of industrial equipment. He was a former partner in the firm of Lester and Silver, management sales consultants in New York and Philadelphia, from which he has resigned to take this new position. His partner, Bernard Lester, is continuing the business and is being retained as consultant by American Wheelabrator. For many years Mr. Silver was executive vice-president of the F. J. Stokes Machine Co., Philadelphia, manufacturers of pharmaceutical and chemical processing and special equipment.

E. B. Rich, new general sales manager, is responsible for all field and direct selling efforts. He is an alumnus of Dartmouth, Northwestern, and Armour Institute of Technology. Starting in 1934 in the company's foundry, he was shifted to Chicago as sales and service engineer and rose to district manager in 1945.

L. L. Andrus will concentrate his efforts in the growing Dust & Fume Division, and particularly in developing equipment and markets.

A. E. Lenhard, advertising and sales promotion manager of the company since 1936, has been made responsible for market research and special work in sales development, working closely with the sales director. He is a member of the National Industrial Advertisers Association.

S. S. Deputy, sales manager, has been given special and sales assignments by the general sales manager.

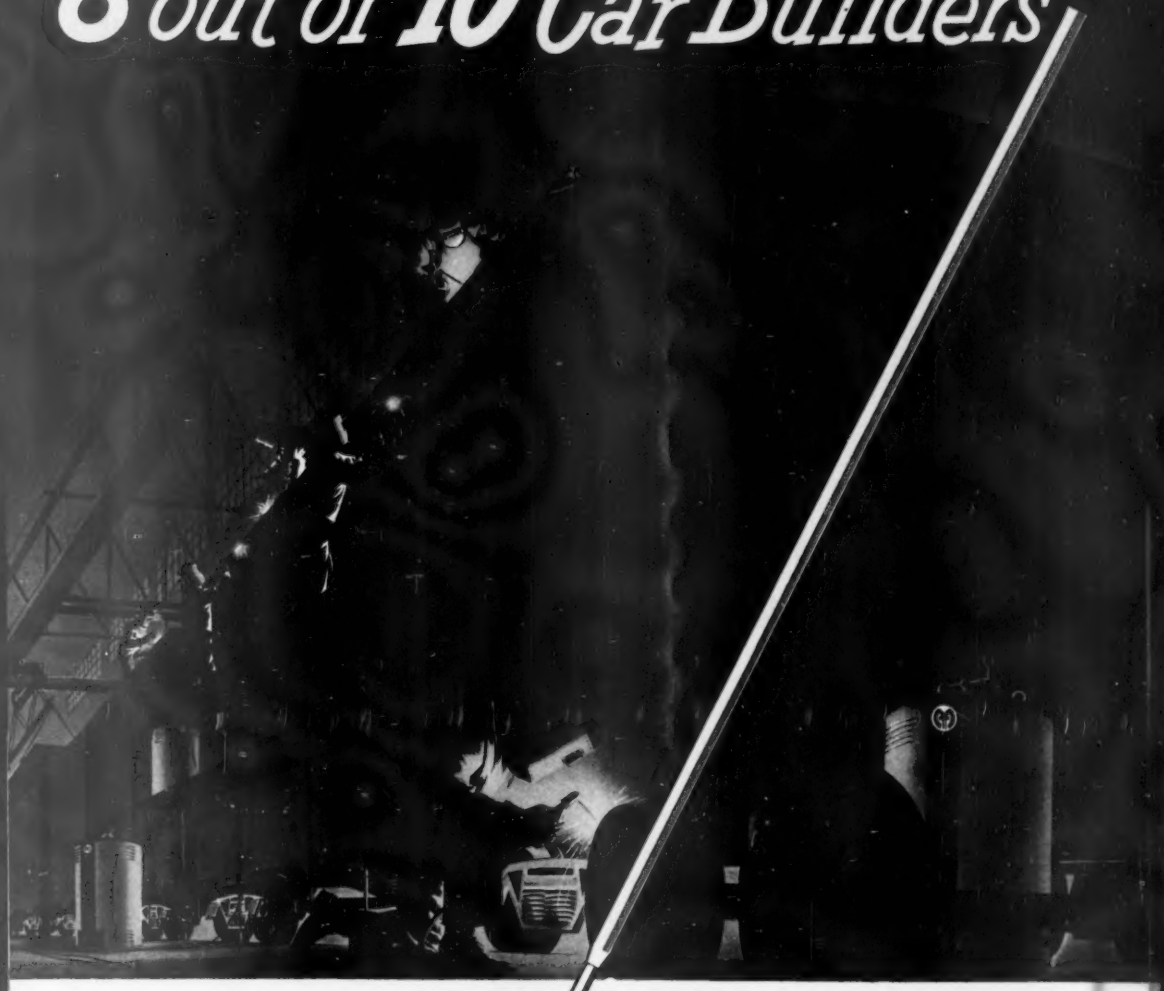
• • •

New Wisconsin Distributor

Newest welding distributor business in Wisconsin is the recently incorporated Northern Welding & Supply Co., 510 South Central Ave., Marshfield.

• • •

8 out of 10 Car Builders



Of the ten leading builders of railroad cars in this country, eight have long been users of Murex Electrodes.*

Alert production men in many industries prefer Murex Electrodes because they mean better, faster welding — increased production rates. And, frequently Murex provides the answer to a difficult welding problem.

*All those who have AAAA directory financial ratings

WELD WITH...

MUREX®

METAL & THERMIT CORPORATION 100 EAST 42nd ST., NEW YORK 17, N. Y.

ELECTRODES • ARC WELDERS • ACCESSORIES

SINGLE GRINDING PASS gives smooth finish to shells of vertical electric motors.

800% faster weld removal with 3M Abrasive Belts!

LOOK AT THESE RESULTS

When Century Electric Company, Saint Louis, Missouri, installed the modern 3M Grinding Method, production of stator shells jumped from 15 to 125 pieces per hour. New backstand equipment and fast-cutting 3M Abrasive Belts eliminated one entire operation. Plus value: a smoother, more attractive finish on each seam.

Converting your present grinding and polishing equipment to this new system is easily done—and at a minimum cost. The 3M Representative in your locality will be glad to check your present finishing operations—point out ways to increase your production, cut your unit costs. Use the coupon below for free help on your grinding problems.

Minnesota Mining & Mfg. Co. WE 851
Saint Paul 6, Minn.

Please send copy of
"Step Up Production" Booklet.

3M ABRASIVE BELTS

NAME_____

FIRM_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Made in U.S.A. by MINNESOTA MINING & MFG. CO., St. Paul 6, Minn., also makers of "Scotch" Brand Pressure-sensitive Tapes, "Scotch" Sound Recording Tape, "Underseal" Rubberized Coating, "Scotchlite" Reflective Sheeting, "Safety-Walk" Non-Slip Surfacing, "3M" Adhesives.
General Export: Durex Abrasives Corp., New Rochelle, N.Y.
In Canada: Minnesota Mining & Mfg. of Canada, Ltd., London, Canada.

NEWLY occupied building boosts output of Precision Welder Mfg. Co.

Precision Welder Expands Welder, Transformer Line

INSTALLATION of new manufacturing facilities in its new building (above), has enabled Precision Welder Mfg. Co., Chicago 10, Ill., to expand its line of welders to include seven models for every use from hobby shop to production and construction welding. Officials of the company are M. S. Adler, president and general manager and H. C. Fields, general sales manager. For distributor information, write to Mr. Fields.

* * *

Ryan Aeronautical Builds New Jet Parts Factory

PRECISION machining equipment, extensive welding and positioning machines, annealing ovens and other stainless-steel fabrication facilities are among the equipment installed in the new $300,000 addition to the Ryan Aeronautical Company's plant at San Diego. The 75,000 sq ft addition will be devoted to the making of combustion chambers, exhaust cones, tailpipes, exhaust nozzles, afterburners and other components for jet engines.

* * *

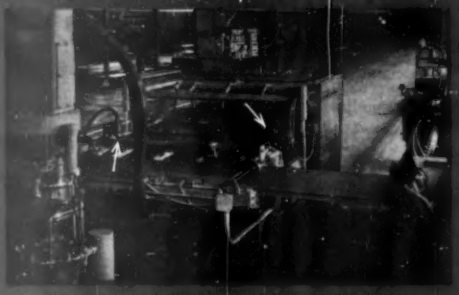
Monsanto Joins Forces To Develop Titanium

IMPROVED processes for the quantity production of titanium will be sought in a joint research venture by Monsanto Chemical Co., St. Louis, and National Research Corp., Cambridge, Mass. The project will be under the direction of Dr. Robert A. Stauffer, vice-president and technical director of National Research, and Dr. N. N. T. Samaras, of Monsanto.

Making steel pipe at Central Valley Pipe Co. Two opposed Vacu-Blast guns, one inside and one outside of formed pipe section. Insert: close up of Vacu-Blast gun midway in pipe section.

Section through typical Vacu-Blast gun showing path of abrasive from blast nozzle to the work and return through vacuum system

Amazing New VACU-BLASTER "SAVES $1,000 A MONTH IN EDGE-CLEANING STEEL PLATE PRIOR TO WELDING"



Vacu-blast cleaning narrow strip on edge of pre-lithographed steel sheet for leading steel drum manufacturer. What other method could do this job.

DEMONSTRATION CAN BE ARRANGED!

VACU-BLAST CO. Inc.

By using Vacu-Blaster to clean a welding strip inside, outside and edge of steel plate, Central Valley Pipe Co. saves $1,000 a month over former method; produces steel pipe fast with no leakers using automatic submerged arc welding.

Such savings are common with revolutionary new Vacu-Blaster—the only blast cleaner with a vacuum pick-up.

Blast can be precisely controlled to clean narrow strip on edges of steel plate or may be used to clean whole surfaces of metal, concrete, wood or brick. There's no flying dust or dirt to bother operator, damage machinery or contaminate product.

Vacu-Blaster reclaims and reuses abrasive, eliminates clean up time. It's portable—can be moved to any job—or installed right in your production line. Makes water tight welded seams with a single pass—ideal for pipe, tank, drum or pail manufacturing, and for fabricating steel structures.

Hundreds of satisfied users. Mail coupon for details about the only blast cleaner with a vacuum pick-up.

Write for FREE BOOKLET!

Vacu-Blast Co., Inc., 683 Peninsular Ave., San Mateo, Calif. We would like your free Vacu-Blaster catalogue____ Wish to arrange for demonstration____ Our problem is____

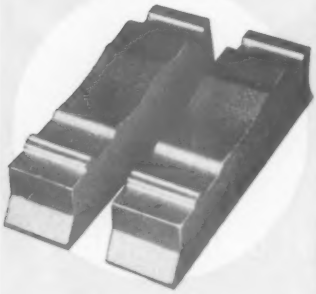
Name____ Position____

Company____

Address____

2258

The DIE is CAST —to Size



...that's why AMPCO WELD* Resistance Welding Dies Save You Time and Money

Just think — when you order "cast-to-shape," "cast-to-size" AMPCO WELD dies, they come to you with tolerances of minus 0, $+\frac{1}{32}$" or plus 0, $-\frac{1}{32}$". There's no machining, no time loss. All you have to do is just put in the cap-screw holes — and brother, you're in production.

You also get longer runs and lower costs, because these dies are made of alloys with high physical properties that meet or exceed RWMA specifications. If you're interested in longer runs for your money, place your order now for AMPCO WELD "cast-to-size" dies.

. . . and Ampco Engineering Service when you need it

Behind the famous AMPCO WELD line of resistance-welding products is a corps of experienced engineers, ready to help you solve your problems. Prompt service from these men is yours whenever you need it. Just get in touch with us.

NW-4

Ampco Metal, Inc.

Dept. WE-8, Milwaukee 46, Wis.
West Coast Plant: Burbank, California

AMPCO®

It's Production-Wise to Ampco-ize!

*Reg. U. S. Pat. Off., Ampco Metal, Inc.

Induction-Weld Tube Mill Makes Electrical Conduit

FIRST and only induction welding tube mill for commercial production is turning out electrical conduit of $\frac{1}{2}$ to 2 in. diameter. The mill is in the plant of Mahoning Valley Steel Co., Niles, O., and was built jointly by The Yoder Co. and Ohio Crankshaft, Inc., both of Cleveland.

First step is to slit the mill-width coils of strip steel into the required sizes for various diameters. The slit strands are recoiled and passed through a resistance seam welder and a flash trimmer, which join and trim the ends of coiled strips before they enter the tube mill.

The tube mill consists of four components: the cold roll forming machine, the induction welder, the sizing machine and the automatic rotary flying cut-off. After the strip has been formed into approximately circular shape, the induction welder heats the abutting edges to welding temperature. Almost simultaneously a pair of rolls presses the edges together to cause fusion. There is no sharp burr or flash at the seam with this process, either on the outside or inside. The latter is most important, since conduit must have a smooth internal surface to meet requirements of the National Board of Fire Underwriters.

The induction welder is supplied by two 9,600-cycle, 800-volt generators, driven by two 150-hp. induction motors. The welded tube enters a 19-ft cooling trough containing a series of water sprays, and then goes into a submerged bath. Continuing in a straight line, the tubing goes to a 3-strand sizing machine where roll pressure decreases its size somewhat but brings it to near-perfect roundness. The final step in the tube-making line consists of cutting the welded tubing into 10-ft lengths, standard for this type of conduit.

* * *

Toronto Welding Men Hear G-E Speaker

MEMBERS of the Toronto chapter of the Canadian Welding Society heard R. W. Tuthill, General Electric Co., speak in May on "Fillerweld Method of Inert-Arc Welding." The meeting was held at Canadian Legion Hall and marked the end of a highly successful season.

E. A. Gill resigned his post of educational chairman for the section because of additional duties in his work with Canadian General Electric Co. He has served in executive positions with the chapter for many years.

A membership of 43 sustaining companies and 130 individuals was reported at season's close.

THE *Right* PROTECTION

is DOCKSON GOGGLES

BE SAFE against sparks, dust particles, chemical splash and fumes, glare and injurious rays with DOCKSON GOGGLES in more than 20 models and a full line of modern lenses for all hazards.

BE COMFORTABLE with smooth-sitting DOCKSON GOGGLES. Excess weight is engineered out.

BE ECONOMICAL, get longer use from DOCKSON GOGGLES. "BUILT FOR BETTER SERVICE".

THERE IS A DOCKSON DISTRIBUTOR NEAR YOU — Let us send you his name and our complete catalog of DOCKSON HEAD AND EYE PROTECTION.

Dockson CORPORATION
3839 WABASH • DETROIT 8, MICH

Cross-section illustrating the exclusive Mallory Fluted water hole.

Mallory Fluted* and Bent** Offset Tips

...the ultimate for your welders

REASONS WHY MALLORY FLUTED TIPS ARE SETTING WELDING RECORDS

- 70% increase in cooling area.
- Positive tube centering.
- Faster heat dissipation.
- Reduced mushrooming.
- Less frequent dressing.
- More rigidity.

Available in all types of tips with #1, #2, and #3 Morse tapers.

*Patent Pending
**U. S. Patent 2,489,993

Practical and effective contributions to cost reduction result from Mallory resistance welding research.

Major contributions are Mallory fluted and bent offset tips, giving you these important advantages:

Cold bent from standard tips with all the desirable physical properties of full hard, extruded and drawn bar stock, not obtainable in forgings or castings.

Water tubes bent in place, bringing effective cooling closer to the welding face.

Fluted water hole increases cooling area 70%, with corresponding increase in heat dissipation.

These exclusive features mean longer tip life, more uniform welds, fewer "downs" for dressing and lower costs . . . all yours at competitive prices!

That's service beyond the sale!

Mallory resistance welding know-how is at your disposal. What Mallory has done for others can be done for you!

In Canada, made and sold by Johnson Matthey and Mallory, Ltd., 110 Industry St., Toronto 15, Ontario

Resistance Welding Tips, Holders, Dies, Rod and Bars, Castings, Forgings

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

SERVING INDUSTRY WITH

Electromechanical Products
Resistors *Switches*
TV Tuners *Vibrators*

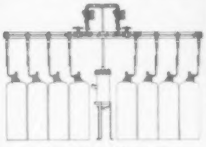
Electrochemical Products
Capacitors *Rectifiers*
Mercury Dry Batteries

Metallurgical Products
Contacts *Special Metals*
Welding Materials

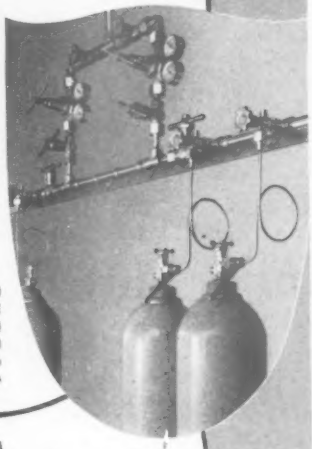
MANIFOLDS

REGO

Typical Single Regulator Wall-Type Oxygen Manifold



Typical Dual Regulator Floor-Type Acetylene Manifold



for OXYGEN
ACETYLENE
HYDROGEN
NITROGEN
and other high pressure gases

Rugged construction and precision control equipment give RegO manifolds long life, safe performance and low maintenance.

Continuous Operation . . . Shut-off valve at each cylinder station permits removal of any cylinder without shutting down entire side of manifold. Master valves control each bank of cylinders.

Unit Construction . . . Header consists of steel I-beam, extra heavy brass pipe and fittings, cylinder station and master shut-off valves . . . with all permanent connections silver brazed.

Precision Regulation . . . Uniform delivery pressure is assured by dual large capacity two-stage Regulators.

REGO

The BASTIAN-BLESSING Company
4201 West Peterson Ave. Chicago 30, Illinois

PIONEER AND LEADER IN THE DESIGN AND MANUFACTURE OF PRECISION EQUIPMENT FOR USING AND CONTROLLING HIGH PRESSURE GASES

*Reg. U. S. Pat. Off.

Miller Electric Magazine Teaches Electricity

ONE of the more attractive company magazines put out by welding manufacturers, the MEMCO NEWS of Miller Electric Manufacturing Co., Appleton, Wis., has a special section teaching the basic fundamentals of electricity. The section is written and illustrated by G. K. Willecke, company physicist and also editor of the magazine.

Each issue of the publication contains a personal message from president N. C. Miller on such points as distributor set-ups, the possibilities of competition, etc.

A series of one-page biographies has been running recently to acquaint company personnel with Miller district sales managers.

High-quality editorials by Mr. Willecke come on the last page of each issue. A recent one asked welding users to make their comments on welding equipment more specific and more scientific so that in the future better equipment could be designed. It does little good to call a welder "too hot" and leave it at that, opines Mr. Willecke.

* * *

Eight Welded Towboats Push Coal Shipments

VITAL river transportation of coal from mines to steel mills is moving faster this summer because of eight new welded steel towboats built by Dravo Corporation, Pittsburgh. They are 108 ft long and each normally moves six river barges loaded with 5,400 tons of coal.

All eight boats were built by time-saving methods. Each hull was built in three major sections, forward, engine room and stern, which were fabricated on specially constructed fitting and welding jigs. Prefabricated assemblies from the structural shop are used for many other parts of the boat.

* * *

Summer Welding School Big Success in Britain

THE British Welding Research Association reports its summer school on welding design and engineering to be a great success. More than 220 students from the British Isles, Holland, Belgium and Norway attended the school, held from May 25 to June 2. Students were busy from 10 a.m. to 10 p.m. and during the week heard no less than 63 lectures, 7 discussions and 8 hours of film displays. The school was at Leamington Spa, Ashorne Hill. A similar school is being planned for 1952.

—*McGraw-Hill World News*

THAT P&H AC WELDER LOOKS GOOD TO ME, JIM. WE CAN GET IT OFF THE FLOOR —AND HAVE MORE ROOM TO WORK!
THAT'S RIGHT, BILL— AND WITH CONTROL AT THE WORK WE GET MORE DONE, AND DO IT BETTER!

Save floor space, cut welding time for more production at lower cost

. . . . use P&H AC Arc Welders with exclusive Dial-lectric remote control

Give yourself more room for your production needs. Mount your P&H Welder off the floor, out of the way.

Dial-lectric remote control lets you do this. Your operator can turn the heat on *at the work*. It also cuts down his "walking time" . . . turns it into *welding* time for increased output.

Besides saving space P&H Dial-lectric control eliminates cores, coils, sprockets, gears and other moving parts that cause excessive maintenance and downtime.

P&H AC Welders are available in a full range of sizes up to 625 amps. See your P&H representative or distributor for full details on how this outstanding welder can save you time and money.

Specialized Training

Metal Welding Fabrication

1 week to 18 months

Harnischfeger Welding Training School

in conjunction with

Milwaukee School of Engineering

Write to P & H today for further details

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WELDING DIVISION
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Excavators • Overhead Cranes • Hoists • Arc Welders and Electrodes • Soil Stabilizer • Crawler and Truck Cranes • Diesel Engines • Cane Loaders • Pre-assembled Houses

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NOW....
AFTER 8 YEARS
OF RESEARCH
A REALLY GOOD
LOW
TEMPERATURE
BRAZING
FLUX....

and it means better and lower cost low temperature brazing

CHEMICALS ARE FINELY GROUND from solids to 44 micron size, with no chemical crystal larger than 0.0017", the equivalent of 325 mesh size and the fineness of the finest face powder. This compares with an average of 40 mesh size crystals used in other commercially important Brazing Fluxes.

THAT'S THE REASON why SIL-FLUX is so "creamy" and smooth, and why it will remain so, indefinitely, even though it may be stored at below zero temperatures. That's only one of the many reasons why SIL-FLUX is such a *really good low temperature* brazing Flux.

SIL-FLUX, compounded in our own Laboratories, is made to an entirely new chemical formula developed by research for us by Battelle Memorial Research Institute.
SIL-FLUX is chemically active at 700° F, (300° to 600° F lower), is faster, more efficient, is visually different, and definitely better than other fluxes.

1. Has greater effective solubility of refractory oxides.
2. Has no brazing gas phase to cause gas pockets, voids, etc.
3. Has a new low surface tension . . . wets and penetrates better.
4. Nothing else as good for close tolerance precision fluxing and brazing.
5. Non-corrosive . . . stable . . . alkaline. Brazed parts don't corrode.
6. No water dilution . . . contains 6% to 18% less water. Water can be added. It's more economical. It's all brazing flux.
7. New Flux-Metal reactions. That's most important. Ask us why.

Send for our free 12 Page Bulletin RESEARCH STUDIES OF BRAZING FLUXES.

The cost is no more at your WELDING SUPPLY JOBBERS

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PROVIDENCE 7- RHODE ISLAND

Official U. S. Navy Photo

BULGED plate from test explosion gives Navy weld strength data

Controlled Explosions Test Welded Ship Plates

To obtain a pattern of weld behavior under general conditions of stress, the Naval Research Laboratory of the Office of Naval Research is carrying explosion-bulge tests of welded plates. Use of such a structural model technique permits welds to be tested under a wide range of known and controlled stress conditions. (See also THE WELDING ENGINEER, March, 1951, page 24).

Such tests have already provided basic information to the investigations of weld fractures now underway at the laboratory. For instance, it's been shown that the stress conditions on structural components far from the weld joint are not accepted as such by the joint. Thus, depending on the overmatching characteristics of the weld and its geometry, an entirely foreign system of stress and strain may be developed in the weld and weld-affected regions.

The test developed by NRL features the bulging of welded plate in diaphragm fashion. Uniform loading is accomplished by the air blast set up by the detonation of a standard military explosive. The test weldment above is a 20 by 22-in. plate made by buttwelding two 10-in. wide, ¾ in. thick firebox steel plates. It is placed over a circular or elliptical opening cut in a 3-in. thick armor saddle plate. The 4-lb circular or elliptical wafer of explosive is located a distance of 12 to 24 in. from the plate.

Plates to be explosion tested can be either heated or made cold by soaking them in a nearby controlled temperature cabinet and removing them just prior to the placement and explosion. Critical temperature control can be obtained by spotwelding thermocouples to the weldment plate and detonating at the required temperature.

HERE'S HOW TO
CUT ELECTRODE WASTE

Good Technique and the Right Rod for the Job Reduce Electrode Waste up to 40%

You can deposit more weld metal, in less time and avoid wasting electrodes by using approved techniques, the right electrode for the job, and by following the manufacturer's recommendations. G-E electrodes give you high deposition rates, meet AWS specifications, and are available in a wide variety of sizes and types.

Get 40 percent more from your electrodes today by:

1. **Avoiding bending whenever possible**
2. **Using electrodes down to a 2-inch stub**
3. **Providing better "fit-ups"**
4. **Protecting welding rods through better storage and care**
5. **Laying flat-face fillets on vertical fillet welds**
6. **Making fillet legs of equal length on horizontal fillets**

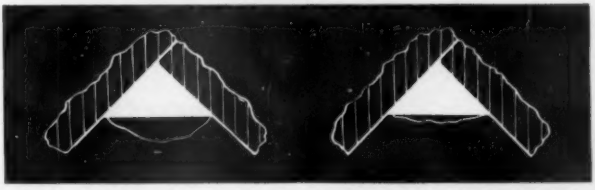
Check your horizontal and vertical fillet-welds against the illustrations on the right. Watch for future hints on improved welding techniques.

Accurate Measurement of Weldments Is Easy with this Gage

Check welds with this corrosion-resisting, stainless steel fillet-weld gage. It is a necessary tool for providing a quick, easy, accurate means of gaging fillets having either straight, concave, or convex contours of the following sizes: ¼ in., ⅜ in., 7/16 in., ½ in., ⅝ in., and ½ in. Easy to carry, it comes complete in a leather case.

Get yours today from your nearest G-E Welding Distributor. He can give you additional hints on how to get the most from your electrodes and equipment. You can find his name in the yellow pages of your telephone directory. Look for "General Electric" under "Welding Equipment."
General Electric Company, Schenectady 5, N. Y.

ON VERTICAL FILLETS



WASTE

On vertical fillets, you may be wasting as much as 40 percent of your weld metal. A poor contour, as shown above, may be due to one or more of the following conditions:

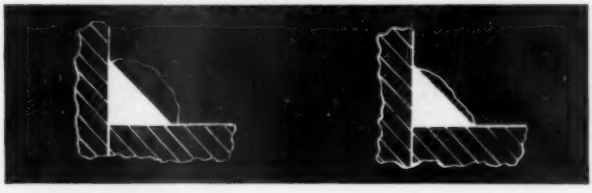
- **Arc length too short**
- **Electrode too large**
- **Forward travel speed too slow**
- **Excess whipping**
- **Excessive current. Metal runs out**
- **Wrong electrode for the job**

GOOD PRACTICE

You can prevent this needless waste of electrode by putting into practice one or more of the following suggestions:

- **Use welding current recommended by the electrode manufacturer**
- **Use as large an electrode as plate thickness will allow, but not larger than 7/16 inch in diameter**
- **Increase travel speed**
- **Change to electrode better suited for this type of joint**

ON HORIZONTAL FILLETS



WASTE

On horizontal fillets, you may be wasting as much as 30 percent of your weld metal. A poor contour may be due to one or more of the following conditions:

- **Electrode held at wrong angle**
- **Electrode too small for size of fillet**
- **Excess current, metal runs down**
- **Arc length too short, causing overlap**
- **Forward travel speed too slow**
- **Wrong electrode for this type of joint**

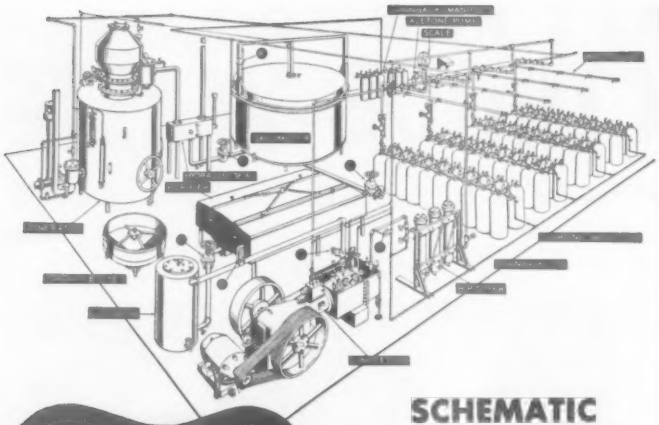
GOOD PRACTICE

You can prevent this needless waste of electrode by putting into practice one or more of the following suggestions:

- **Hold electrode at proper angle**
- **Use as large an electrode as possible**
- **Use welding current recommended by the electrode manufacturer**
- **Increase travel speed**
- **Use proper electrode for this type of joint**

712-6

GENERAL ELECTRIC



A Low Pressure
ACETYLENE
PRODUCING
PLANT
that Charges up to
160 CYLINDERS
at ONE TIME

SCHEMATIC
PLANT ASSEMBLY

SHOWING LOCATION OF UNITS
THAT MAKE UP THE PLANT

This plant layout provides simplest operation at low production costs. Compact design allows operator to watch all operations at all times.

LOW PRESSURE
GENERATOR

This 600-lb. acetylene generator fits into the above plant assembly. It stands out as one of the safest plants manufactured. Automatic controls minimize operating personnel. Rated capacity of the generator and plant assembly is 2700 cu. ft. per hour. The other units are designed for maximum production at minimum costs.

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YOUR
INQUIRIES

INDEPENDENT ENGINEERING COMPANY, Inc.
Manufacturers of
CONSULTING · DESIGNING · RESEARCH
CYLINDERS AND GAS PRODUCING EQUIPMENT
ACETYLENE · OXYGEN · HYDROGEN · NITROGEN
O'FALLON, ILLINOIS

Precision Stainless Parts Fabricated on Conveyor Line

SOLAR Aircraft Corporation's San Diego plant has just completed installation of five production lines for precision fabricating of stainless steel aircraft assemblies. It is the first such on the West coast.

Extreme high quality and close tolerances are required in the assemblies, some of which are combustion chambers for J-47 jet engines. The conveyor system speeds range from five eighths of a ft per minute to two and a half ft per minute. Some five times the former production is said to be achieved with the system. Special training classes were set up to train relief personnel for the moving lines so that the flow would not be hampered by fatigue or shifting of workers.

Stationed along the conveyor lines are 12 hydraulic and mechanical presses, the largest having a 200 ton capacity. For joining stainless steel parts, 30 resistance welders are included. Special units have been designed for automatic cleaning of parts during processing.

* * *

"Stump the Experts" Night Entertains Niagara Weldors

THE Niagara District chapter of the Canadian Welding Society was host this year at the annual "Stump the Experts" night. The winning team came from Toronto. Other chapters entering teams of experts were Niagara, Hamilton and Kitchener.

Members of the winning team were A. S. Tuttle, M. J. Waite, and Sid Smith. Judges were J. M. Gulley, Henry Hamel, M. S. Mark and A. E. Ellis.

Other teams included the following men: Niagara, Allan Clarke, R. F. Scott, Andy Black and C. W. Morehead; Hamilton, S. P. Lockhart, W. W. Burchell, R. J. Millar and R. E. Miller; Kitchener, J. R. Scott, A. A. Verch, S. J. Hardy and N. T. Perrin.

The Niagara chapter finished the season with 17 sustaining companies and 50 members.

* * *

Milwaukee Distributor Buys Bradshaw Weldors Supply

LES DLOUHY, owner and operator of Superior Welding Supply, Milwaukee, Wis., has purchased Bradshaw Weldors Supply, Waukesha, Wis., from Otto Bradshaw. The Bradshaw name of the firm will not be changed, and present employees will continue to work there, according to Mr. Dlouhy.

Mallory Holds Sales Meetings For Branch, Division Managers

SIX days of sales meetings were recently concluded for division and branch managers of P. R. Mallory & Company, Inc., Indianapolis, Ind., manufacturer of resistance welding electrodes and other electrical equipment.

Direction of the meetings was by J. E. Cain, president, Ray F. Sparrow, senior vice-president and Harold C. Buell, general sales manager. Managers from ten divisions and 11 branch sales offices attended.

Mallory employs a total of 4,500 people at three plants in Indianapolis and in branch and subsidiary plants in Chicago, Detroit, Frankfort, Ind., and Tarrytown, N. Y.

* * *

Private Steel Mill Going Up for LeTourneau

BECAUSE of the critical shortage of steel, R. G. LeTourneau, Inc., has started construction of its own steel mill at its Longview, Tex., plant. Expected to be in operation by year's end, the mill will have a capacity of 1,000 tons per day of finished steel plate 144 in. wide, ranging in thickness from 3/16 to 12 in.

Two electric furnaces will utilize LeTourneau scrap and other scrap purchased in the Longview area. Rollers in the rolling mill will be the largest in the steel industry, according to LeTourneau, one being 58 in. in diameter and the other 36 in. An 8,000 hp drive will be used in the rolling mill.

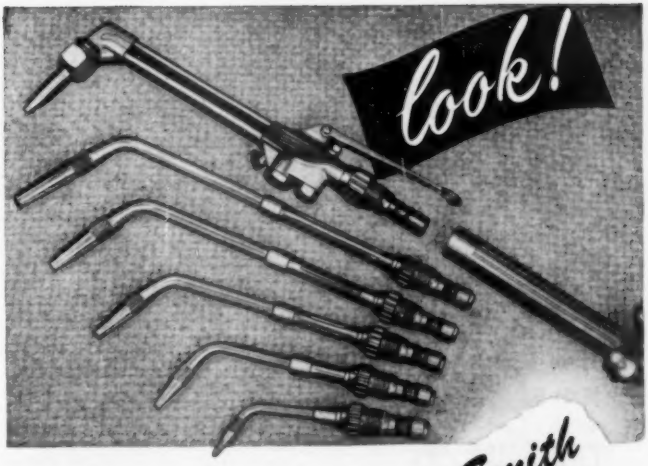
A new building 500 by 100 ft will house the mill.

* * *

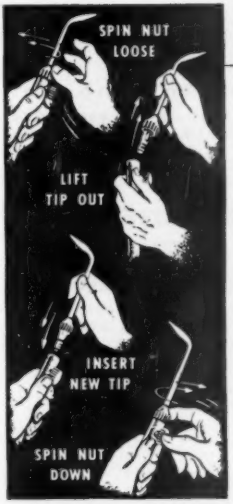
New Officers Chosen By Hamilton, Ont. Weldors

FINAL meeting of the 1950-51 season of the Hamilton, Ont., chapter of the Canadian Welding Society saw the election of new officers for this fall. They are: R. R. Kottmeier, Canadian Liquid Air Co., chairman; A. R. Jacobs, Lincoln Electric Company of Canada, first vice-chairman; A. J. Vella, Brantford Massey Harris Company Ltd., second vice-chairman; S. P. Lockhart, Provo Construction Co., secretary; W. R. Rowbotham, International Harvester Co., treasurer. Past chairman is Charles H. Clark, International Harvester Co.

In recognition of the excellent service given the chapter at monthly meetings, a substantial check was given the building fund of McMaster University. The year's end showed a chapter roll of 23 sustaining companies and 90 individuals.



You can change these Smith 1 Tips in 6 Seconds



- No wrench necessary
- Fingers do the job
- Fast line-up of tip
- Fast change from welding to cutting

How do you like that for fast, efficient operation? No searching for wrenches—no wasted time. Just use fingers only. In actual demonstrations, operators have been able to remove and replace 4 tips in the time another operator could remove and replace 1 tip in an old fashioned model. And the seal stays tight even if tip is battered or nicked!

This is the kind of progress modern industry needs and wants. But it's not the only advantage you get with this new Smith equipment. Note that the Cutting Assembly can be attached just as quickly as a tip and the new "FLO-TROL" feature eliminates reverse flow of gas—prevents burned out seats. Keeps torch on the job . . . does away with costly delays. Another ingenious feature permits rotating the tip **while flame is burning!** (Heavy Duty Torch Body and Cutting Assembly, illustrated above, carries Lifelong Guarantee).

THAT'S ALL! . . . JUST *6 SECONDS;* IT'S NEW AND REVOLUTIONARY

MAIL COUPON TODAY FOR DETAILS

SMITH WELDING EQUIPMENT CORPORATION
Manufacturers of fine Welding Equipment for over 40 Years

Smith Welding Equipment Corporation
2635 S.E. 4th, Minneapolis, Minn.

Please send me more information on the time-saving and money-saving features of your new torch.

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Address_____
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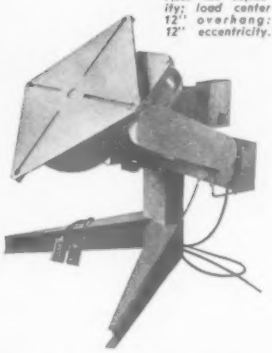
PUSH BUTTON POSITIONING
BOOSTS WELDING FOOTAGE•

WELDMORE
The POSITIONER
with Production in Mind



Model 75MYRMT; 7,500 lb. capacity; load center 12" overhang; 12" eccentricity.

● At any rotation speed—at any elevation—the new Weldmore boosts production by making easy all awkward position welding. Table rotation and tilt fingertip controlled. 135° table tilt with safety limit stops. Impact loading minimized for safety.

Send for complete specifications on this and other models, having capacities of 3,000; 18,000; and 25,000 lbs.

PANDJIRIS WELDMENT CO.
5151 NORTHRUP – ST. LOUIS 10, MO.

WELDING GANTRIES—WALL TRACK PLANOGRAPH WELD ARMS—TURNING ROLLS—TANK JIGS—TUBE BENDERS—HYDRAULIC COIL MANDRELS—SPECIAL POWER WELD TOOLS

An Unbeatable Combination!
SILVALOY SILVER BRAZING ALLOYS

The Silvaloy group consists of 7 popular silver brazing alloys high in tensile strength and producing strong, ductile joints on ferrous and non-ferrous metals.

	SILVER CONTENT	MELTING POINT	FLOW POINT
SILVALOY 50	50%	1160 F	1175 F
SILVALOY 45	45%	1125 F	1145 F
SILVALOY 40	40%	1135 F	1205 F
SILVALOY 35	35%	1125 F	1295 F
SILVALOY 20	20%	1430 F	1500 F
SILVALOY 15	15%	1185 F	1280 F
SILVALOY 503	50%	1195 F	1270 F

1200 All-Purpose Flux—for use on all metals. No. 1200 Flux readily dissolves oxides during brazing operations and aids in the flowing of the alloy. Meets all government specifications.

1100 Low Temperature Flux—superior where exceptionally clean surfaces on copper or copper alloys are required at lower temperatures.

COMPLETE STOCKS

Oxy-acetelyne welding rods and flux for cast iron, steel, aluminum, brass, copper, bronze, nickel, monel and inconel.

STEEL SALES CORPORATION
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BRANCH PLANTS: Detroit, St. Louis • BRANCH OFFICES: Milwaukee, Minneapolis, Grand Rapids, Indianapolis, Kansas City, Mo.

Book Reviews

Arc Welding

NEW LESSONS IN ARC WELDING. Published by Lincoln Electric Co., Cleveland 17, O. 1951. Simulated leather, 5½ x 8½ in., 312 pages. Price $1.

Practical fundamentals of arc welding are packed into *New Lessons in Arc Welding* as well as more advanced welding instructions for alloys, sheet metal and piping. Each chapter in the book is itself a lesson in arc welding. First 32 in the book cover the welding of mild steel. The last 29 tell about the joining of various alloy steels, stainless, aluminum, copper, manganese and also about many different types of hard-facing applications.

Treating various welding applications, the book is divided into five parts: (1) the latest welding procedures and cost-saving methods (2) automatic and semi-automatic submerged arc welding procedures (3) how metals are made and how to identify them (4) how to select correct welding joints and (5) how to make common machine parts by using weldments instead of castings.

Profusely illustrated, the text is generously supplemented with tables, charts and drawings. This makes it a valuable reference book for all who are interested in welding as well as an interesting text for those who are learning the art.

* * *

Metal Processing

METAL PROCESSING, Second Edition. By O. W. Boston. Published by John Wiley & Sons, Inc., New York, 1951. Cloth, 6 x 9 in., 703 pages. Price $7.50.

The second edition of *Metal Processing* is a complete revision of the book that appeared ten years ago, except for one important phase of metal working. By failing to treat properly modern welding processes, the author has made a considerable omission. The only reference to welding indicates that it "lends itself very satisfactorily to producing parts at a high rate and low final cost."

Otherwise, the author provides detailed information on machine processing, accessories and tools. He also illustrates the correlation between design, metals and manufacturing of a product. Steps involved in designing for production are covered in the first chapter. The subsequent 18 chapters treat the various classes of machines with the processes and/or factors with which they are involved. The final chapter deals with accounting and cost.

About People

RAYMOND C. FREEMAN has been named manager of the General Electric Company's welding divisions at Fitchburg, Mass. ALANSON U. WELCH will succeed him in his former post of manager of engineering of the welding divisions. Mr. Freeman joined G-E in 1929 and in 1937 became section engineer in the welding divisions then located at Lynn.

* * *

DR. C. J. BREITWIESER, has been appointed executive assistant to Dr. F. R. Hensel, vice-president in charge of engineering at P. R. Mallory & Co., Inc. He was formerly chief of electronics and head of the engineering laboratories at Consolidated Vultee Aircraft Corp., Lindbergh Field, San Diego.

* * *

RENE D. WASSERMAN, director of research and president of Eutectic Welding Alloys Corp., Flusing, N. Y., has been named to the research committee of the National Association of Manufacturers.

* * *

JOHN F. APSEY JR., advertising manager of The Black & Decker Mfg. Co., Towson, Md., was elected president of the National Industrial Advertisers Association recently.

* * *

RALPH M. JOHNSON, vice-president in charge of sales for Norton Co., was elected president of the American Supply and Machinery Manufacturers Association at its recent San Francisco meeting.

* * *

PAUL E. PALMER has recently joined the welding sales staff of Metal & Thermit Corp., East Chicago, Ind. He was formerly with La Plant-Choate Co., Cedar Rapids, Ia., as head of standards.

* * *

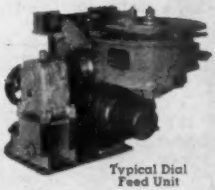
HENRY L. HOWARD has been appointed manager of the new office and warehouse of Wall Colmonoy Corporation at 5815 Clinton Drive in Houston, Tex. Mr. Howard has been a welding engineer for Goodyear Aircraft Company and Republic Steel Company as well as a sales engineer for a large Texas welding distributor.

* * *

L. E. MENNS has been named Pacific coast sales manager of The Bridgeport Brass Co. He has been Los Angeles district manager.

Federal

AUTOMATIC FEEDING DEVICES BOOST PRODUCTION AS MUCH AS 400%



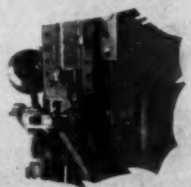
Typical Dial Feed Unit

If you are making long runs of welded parts, and are interested in increasing production and product quality, you should know about Federal Welder indexing tables, dial feeds, automatic feeding, loading and unloading devices.

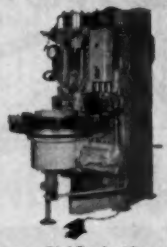
Ideal for large production runs, these Federal automatic devices pay for themselves in short order. Usually adaptable to a standard welder, they reduce the cost of the completed assembly by reducing the man hours required to perform the welding operation. It is not uncommon for an automatic feed to quadruple production over the hand fed method, and, in addition, save 50-70 percent of assembly time.

Federal automatic feeding devices lower production time by eliminating welder down time, and by eliminating fitting, clamping and other operator handling required by piece work methods.

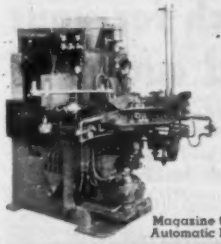
Federal automatic devices permit the welder to deliver welds of consistent high quality and uniformity. Once conditions are set they continue with every weld — eliminating the chance of human error.



Hopper, automatic feed, automatic ejection unit attached to welder



Dial Feed with automatic ejection



Magazine type Automatic Feed

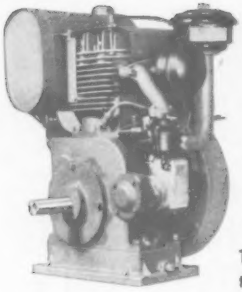
Federal can furnish automatic equipment for almost any welding operation suitable for automatic feeding. For further data contact the Federal representative nearest you — or write and we will have him call on you at your convenience.

Federal® WELDERS

Warco PRESSES®

THE FEDERAL MACHINE & WELDER COMPANY

WARREN, OHIO



Four Single-Cylinder WISCONSIN *Air-Cooled* ENGINES Offering More POWER ADVANTAGE, 6 to 9 hp.

This series of single-cylinder models have all of the traditional Wisconsin heavy-duty features such as self-cleaning tapered roller bearings at both ends of the crankshaft, rotary-type, high tension OUTSIDE magneto operating as an independent unit, and maximum torque at all usable speeds.

CONDENSED SPECIFICATIONS

MODELS	AEH	AFH	AGH	AHH
Bore - - - - - - - - - inches	3	3¼	3½	3⅜
Stroke - - - - - - - - - inches	3¼	4	4	4
Disp. cubic inches - - - - - - - - -	23	33.2	38.5	41.3
H. P. and R.P.M. range - - - - - - -	3.9 at 1600	6.0 at 1600	7.2 at 1600	7.7 at 1600
	6.1 at 2600	7.2 at 2200	8.4 at 2200	9.2 at 2200
Net weight in lbs., Standard Engine - - -	130	180	180	180

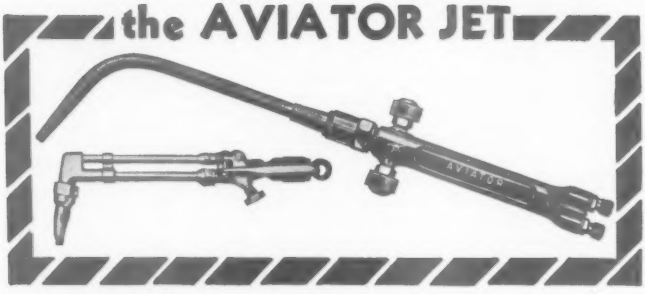
Our engineering department will gladly cooperate with you in adapting Wisconsin Engines to your requirements. Write for detailed data and name of the nearest Wisconsin distributor.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46 WISCONSIN

the AVIATOR JET



a double-duty torch for your light welding and cutting

The "Jet" is as new and different as its name implies... designed for two operations from a single torch. It consists of two units, with the cutting attachment identical to that used with the famous WELDMASTER Torch, scaled down for lighter duty. For precision work with an eye on economy—*you'll want* the new MECO Aviator Jet.

Write for MECO Catalog #140 Today

Meco **Modern Engineering CO., Inc.**

3411-C PINE BLVD. ST. LOUIS 3, MO.

EDWARD H. ROPER has been appointed manager of the general technical sales department of Air Reduction Sales Co. With Air Reduction since 1936, he has been an active member of ASME and AWS. He is a co-author of *Oxygen Cutting*, a recent textbook on oxyacetylene cutting.

* * *

S. D. BAUMER has been named vice-president of the Airco Equipment Manufacturing Division of Air Reduction Company, Inc. He joined Airco in 1941 as a steel mill specialist in the general technical sales department, was appointed assistant manager of the department in 1944 and manager in 1948.

* * *

ALFRED IDDLES, president of The Babcock & Wilcox Company, was given the honorary degree of Doctor of Engineering by Polytechnic Institute of Brooklyn recently.

* * *

A. F. VINSON has been appointed manager of employee and community relations of General Electric's small apparatus divisons. He was appointed chairman of the committee in charge of the former welding equipment divisions in 1947 and a year later became manager of the welding divisions at Fitchburg, Mass.

* * *

EVERETT M. HICKS, manager of Norton Company's grinding machine division has been appointed a member of the Industry Advisory Committee of the Office of Price Stabilization.

* * *

LESLIE G. HULBERT has been named manager of market development division of United States Steel Supply Co.

* * *

DR. EGON OROWAN has been appointed George Westinghouse Professor of Mechanical Engineering at the Massachusetts Institute of Technology.

* * *

I. F. THOMAS has been appointed manager of the new western district office of the S. S. White Industrial Division with headquarters at Long Beach, Calif.

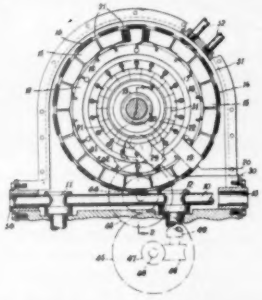
* * *

HARRY NOWICKI has been appointed district manager of the eastern Texas division of Ampco Metal, Inc. with headquarters at Houston. He was formerly in the Chicago office. SAM CODDINGTON, Wisconsin district field engineer, has been transferred to Chicago in Mr. Nowicki's place.

From the Patent Office

Induction Welding Tubing

2,552,514. CLAUDE A. BOWLUS, Detroit. Filed Feb. 3, 1949. Granted May 15, 1951.

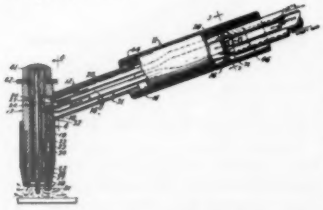


Patent refers to an apparatus for inductively heating a workpiece by subjecting it to the rapid approach and withdrawal of a successive series of magnetic fields. The holding position is in relation to a rotatable armature having a number of magnetic poles around its periphery. The poles make successive arcuate movements about the workpiece in rapid succesion. The tubing edges become heated and are welded together.

* * *

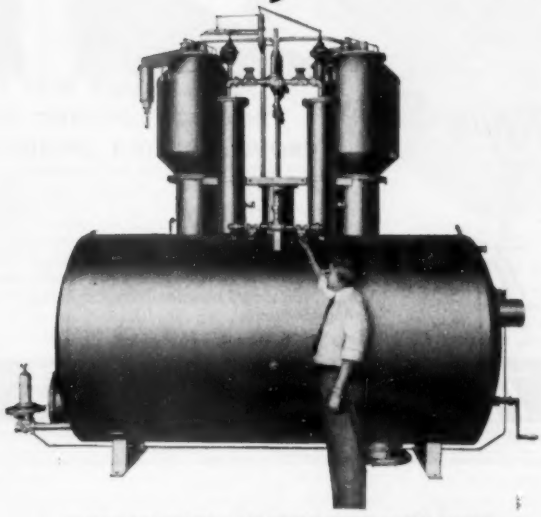
Water-Cooled Electrode Holder

2,554,236. ARTHUR A. BERNARD, Chicago. Filed March 2, 1949. Granted May 22, 1951.



Patent covers an electrode holder that has a head for holding the electrode near the exposed end. The head has a cooling passage formed in part by and surrounding the electrode to carry liquid in direct contact with the electrode. There are provisions for carrying the liquid through the passage and away from the torch.

IF YOUR PLANT USES LARGE QUANTITIES OF *Acetylene*...



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Convenience! Dependability! Economy!

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MODEL A-TWIN GENERATOR

• *Continuous Flow* • *Virtually Automatic Operation*

Modern industry today produces its **OWN** supply of acetylene, piped from a central source to points of usage within the plant—just like water, compressed air and other utilities. No clumsy cylinders to move around workmen and to check in and out. No shutting down while cylinders are being connected. And . . . no loss of acetylene returned in "empty" bottles!

The Model A-Twin Generator produces a dependable, even flow of the purest acetylene possible . . . continuously if desired. When one carbide hopper is empty, the other automatically goes into service. The Sight Feed "A-Twin" is simple to operate and supplies acetylene **WHEN** you want it . . . at a saving of 50% to 75% of the cost of "bottled" acetylene. Manufactured in sizes to suit requirements.

FOR COMPLETE INFORMATION

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THE SIGHT FEED GENERATOR COMPANY

"Manufacturers of Welding Equipment for more than 25 Years"

OFFICES AND FACTORY: WEST ALEXANDRIA, OHIO, U.S.A.

Tippy Says:

JULIUS CAESAR WAS A "HOT ROD" JOHNNY HE DROVE A WELDED CHARIOT!

Caesar played it safe . . . he knew he could be reckless in a welded chariot! Why don't you play it safe . . . use TIPALOY Resistance Welding Electrodes that will keep your production costs on the safe side . . . yet give you so much more than ordinary electrodes . . . LOOK! . . . less mushrooming, less redressing and greater current density . . . investigate NOW! . . . you should be using TIPALOY Resistance Welding Electrodes!

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to eliminate weld spatter cleanup

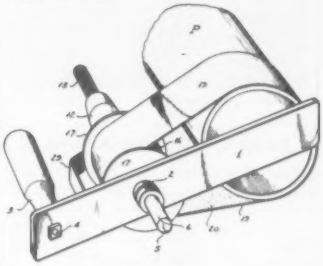
Unsightly costly weld spatter simply wipes off, in a matter of seconds, when you brush or spray Protect-O-Metal No. 2 in the weld seam and on adjacent surfaces before welding. And you save up to 85% of weld cleaning labor, conserve man-hours for productive work. Welders like Protect-O-Metal because it contains no organic materials, cannot cause smoke, fumes, or odors. *A little goes a long way* . . . costs 1/10c per foot of weld . . . saves up to three times its cost in time savings alone. Order a trial gallon ($3.25) on a no risk basis. If you're not completely satisfied we will cancel the invoice.

PROTECT-O-METAL POM

G. W. Smith & Sons, Inc. GWSMITH 5408 Kemp Rd., Dayton, O.

Preparing Pipes for Brazing

2,556,041. LEWIS G. PICK, Tuckahoe, N. Y. Filed Oct. 25, 1949. Granted June 5, 1951.



Patent covers a device for preparing the surface of the end of a pipe to be brazed or soldered. It includes a guide bar, a driving spindle journalled for rotation and between the ends of the guide bar with its axis normal to the bar, a pulley fixed on the driving spindle and an internal abrasive belt to embrace the pulley and bar. The guide bar extends radially of the pulley a distance greater than the span of the belt to abut the end of the pipe.

• • •

Stud Welding Method

2,553,499. HAROLD J. GRAHAM, Highland Park, Mich. Assigned to Graham Mfg. Corp., Detroit. Filed Jan. 17, 1950. Granted May 15, 1951.

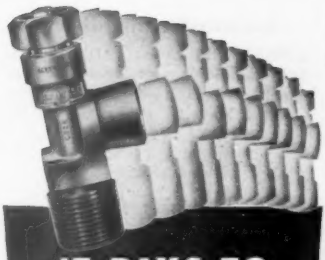
Patent covers an arc stud welding method that includes studs having a tiny projection sticking out on the welding end. This tip is covered with a breakable and insulating head. When the head comes in contact with the work surface, and voltage is applied to the stud, pressure is also applied to the tip to disintegrate the head. The contact area then becomes ionized to form an arc prior to full metallic contact of the stud and said surface.

• • •

Underwater Welding Electrode

2,552,176. WERNER HUMMITZSCH, Kapfenberg, Austria. Assigned to Gebr. Bohler & Co. Aktiengesellschaft, Vienna. Filed Feb. 27, 1948.

Patent pertains to an electrode useful for both welding and cutting under water by merely varying the applied current for either purpose. It comprises a cored wire having compounds ionizable in the electric arc. The cores comprises 1 to 10% of the cross section of the combined wire and core. The cored wire is coated with a mixture of mineral oxides and ferro-alloys. It is further protected by an outer coating of a water resistant, electrically insulated varnish.



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for Welding of ALUMINUM
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Types 142, 195, 355 and 356
for Better Welding
3/16" size only

Aluminum Solder
White Metal

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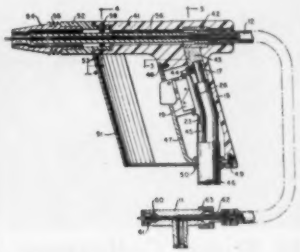
744 Broad St. Newark 2, N. J.

Inert-Arc Metal-Arc

2,544,801. ALBERT MULLER, Plainfield, and GLENN J. GIBSON, New Providence, N. J. Assigned to Air Reduction Co., Inc., New York City. Filed July 14, 1950. Granted March 13, 1951.



Patent refers to apparatus for inert-gas-shielded metal arc welding. The apparatus includes a wire guide and contact tube for guiding and supplying current to a consumable metal electrode. The electrode is fed continuously through the tube to an arc formed between the electrode end and the workpiece. A barrel surrounds the tube and is spaced from it to form an unobstructed flow passage of constant cross-sectional area. This passage terminates at its exit end in a nozzle orifice having a diameter of not less than five times the diameter of the electrode. It extends rearwardly from the nozzle orifice a distance of at least five times the diameter of the nozzle orifice. There are means for admitting an inert gas into the inlet end of the unobstructed passage, whereby a non-turbulent inert-gas shield is formed about the arc to shield it from the air.

* * *

Acetylene Generator

2,543,662. ROBERT RENE LOUIS GEFFROY, Neuilly-sur-Seine, France. Assigned to Societe: Volcan S. A., Levallois, France. Filed Dec. 3, 1946. Granted Feb. 27, 1951.

A newly patented acetylene generator includes a carbide basket that can be placed in the tank from the top. A counter-pressure box sealed at its upper end contains a pressure regulating air cushion and has an opening on its lower end opening into the tank below water level. This box rests on a support member attached to the inner surface of the tank. The support member and box are shaped so that the upper end of the box doesn't move sideways into the path of the basket. The tank cover, box and basket are all separately removable from the tank.

For Two-Fisted Welders
Who Work With Bared Chest

No. 241
Helmet

It's a brand new, one-piece moulded Welding Helmet, made to satisfy the most critical welder.

It is especially designed for men who, during hot weather, work with their shirt open. It has a straight front, long enough to give full protection to the bared chest, yet permits full movement and assures the greatest possible comfort. It is well balanced, can be furnished with any of our three head gears, and with either the standard or special Lift-Front lens retainer.

Here Is a
Special Proposition

This is a helmet of such outstanding quality that we ask you to permit us to forward a sample of this No. 241 Helmet on memo for examination purposes. Examine it thoroughly, test it, satisfy yourself that in truth this helmet is what we claim it to be—"one of the best."

There is an old saying that "tomorrow never comes." Write us today for a sample helmet for inspection purposes and for the name of a near-by dealer who can supply you. The helmet will come to you parcel post prepaid.

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MANUFACTURING COMPANY
Sellstrom Safeguards Your Eyes and Face
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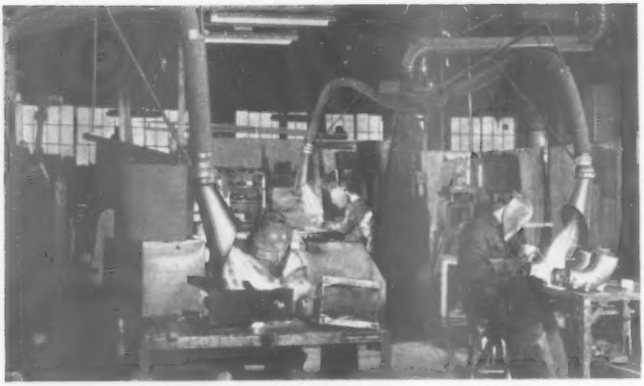

Group of RUEMELIN Fume Collectors Keeps Shop Clear of Welding Fumes

This well ventilated welding department is typical of hundreds of similar installations. Welding operators appreciate smoke and gas-free atmosphere. Thousands in service. Many repeat orders. Collecting fumes at the source with local exhaust hoods has proven most practical in operation. Write for Bulletin 37-D describing all types of Ruemelin Fume Collectors.

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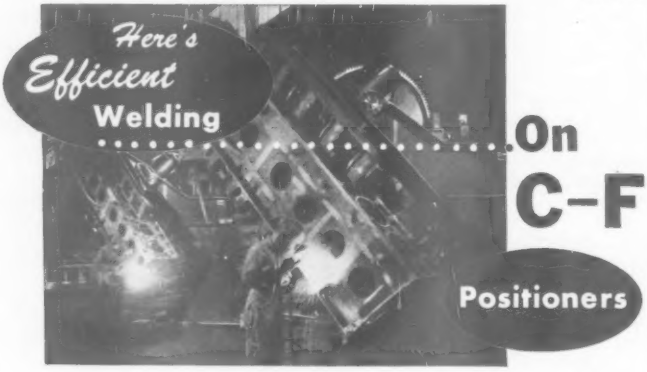
3880 NORTH PALMER STREET • MILWAUKEE 12, WISCONSIN, U. S. A.

A 5911-36



When heavy, unwieldy weldments like these diesel crank cases can be quickly swung into any position so that every weld is made **downhand**—that's efficient welding!

Weldors spend more time welding—do better welding at lower cost when they work with C-F Positioners because these hand and/or power operated machines reduce positioning time to a minimum. Investigate the cost-saving advantages of C-F Positioners. They pay their way in any company.

Write for Bulletin WP24—an illustrated circular detailing the **Specific** advantages of C-F Positioners.

Cullen-Friestedt Co., 1309 S. Kilbourn Ave.

CULLEN-FRIESTEDT CO., CHICAGO 23, ILL.

C-F positioned welds mean better, more economical welds

Inert-Arc Electrode Holder

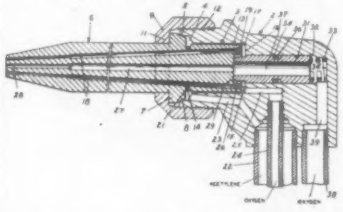
2,555,017. Roger W. Tuthill, West Springfield, Mass. Assigned to General Electric Co. Filed Aug. 18, 1949. Granted May 29, 1951.

Patent pertains to an electrode holder for use in inert gas shielded arc welding. It has an insulated handle with gas and electric conduits in it. A flexible non-resilient metal tubing is connected at one end to receive gas and electricity from the conduits. The tubing has at least one gas outlet formed in the opposite end. A silicone rubber sheath encases the tubing and ends at a point next to the gas outlet. Electrode gripping jaws are secured to the tubing for holding a welding electrode axially from within the gas outlet end.

* * *

Acetylene Cutting Torch

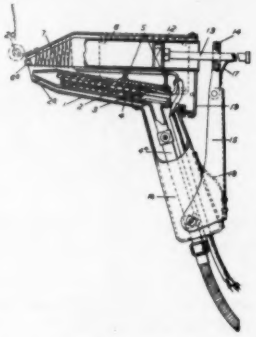
2,552,873. Elmer H. Smith, Minneapolis, assigned to Smith Welding Equipment Corp., Minneapolis. Filed Dec. 24, 1948. Granted May 15, 1951.



Patent covers an acetylene torch having a head with an enlarged bore open at one end and a smaller bore aligned with the larger. A spring-pressed tubular seal in the smaller bore has one end in communication with a supply of high pressure cutting gas. The torch tip has a cylindrical end part slidably receivable in the larger bore and has a suitable cutting gas passage extending lengthwise through it. It is also in communication with the seal. The tip has a number of preheating fuel passages in it.

Plastic Welding Gun

2,556,609. RICHARD SMURTHWAITE ARKLESS, Billingham-on-Tees, England. Filed April 18, 1949. Granted June 12, 1951.



Patent pertains to a plastic extrusion welding gun, including a heating barrel, a nozzle on it, a cylinder for holding thermoplastic material and, in the axial plane of the barrel, an extrusion nozzle on the end of the cylinder. The cylinder nozzle is right next to the barrel nozzle. A piston in the cylinder presses against the thermoplastic. A heating coil is positioned around the cylinder nozzle. A tube around the barrel and communicating with it carries an inert gas. When the piston forces the thermoplastic out the nozzle, it is extruded into the path of the heated inert gas.

* * *

Aluminum Welding Flux

2,552,105. MIKE A. MILLER and WARREN E. HAUPIN, New Kensington, Pa. Assigned to Aluminum Company of America. Filed Jan. 15, 1949. Granted May 8, 1951.

New aluminum welding flux has the following composition of nonhygroscopic salts: about 33% by weight sodium chloride, 33% potassium chloride, 15% lithium fluoride, 7.5% aluminum fluoride, 8% magnesium fluoride and 3.5% alkaline earth sulfate.

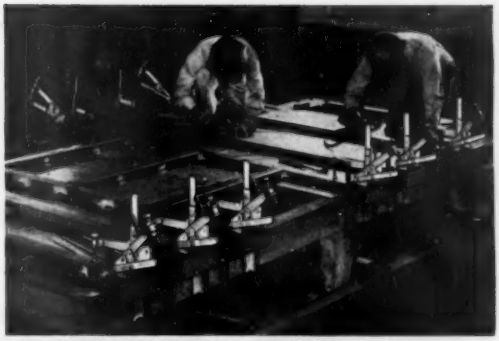
* * *

Aluminum Welding Flux

2,552,104. MIKE A. MILLER and WARREN E. HAUPIN, New Kensington, Pa. Assigned to Aluminum Company of America. Filed Jan. 15, 1949. Granted May 8, 1951.

An aluminum welding flux that is newly patented is composed of nonhygroscopic salts, comprising about 33% by weight sodium chloride, 34% potassium chloride, 15% lithium fluoride, 10.5% aluminum fluoride, 4.5% sodium fluoride and 3% alkaline earth sulfate.

Production Welders Locate and HOLD with "DE-STA-CO" clamps



Revised 32-page catalog of toggle clamps, accessories, applications. Template sheets for efficient fixture design.

Precision clamp manufacture and high holding-pressures are the "secret" of this efficient welding fixture. Locating pins welded to clamp bars hold channels in positions to weld variable length assemblies in this versatile fixture. "De-Sta-Co" reamed holes and hardened pins assure accurate positioning of parts. Positive holding pressure forces cross members and plates into close contact essential for strong production welding. And "De-Sta-Co" quick toggle action makes loading a job untrained workers, even women operators, handle with ease, in seconds.

More than forty "De-Sta-Co" models—including new portable and plunger clamps—offer quick solutions to your locating and holding problems. The "De-Sta-Co" stocking distributor in your area is qualified to assist you; call him in, or, if you haven't met him, write for his name and your copy of our catalog, today.

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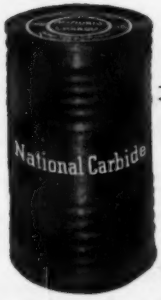

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NATIONAL CARBIDE COMPANY

A Division of Air Reduction Company, Inc.

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Here's a real positive lock with low resistance and quick disconnect. The Heavy Duty and General Purpose sizes are completely interchangeable. Connect all cables, No. 2 through 4/0 without adapters. Self-compensating for wear. Locks tight—stays tight—releases easily. Field proven on the toughest jobs.

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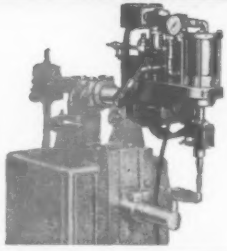

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Write for our current available Welder List.

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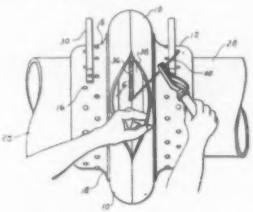
40 S. Clinton Street Chicago 6, Ill.

Windshield for Welding

2,553,899. OSCAR E. DEMPSEY, Tulsa, Okla. Assigned to Dempsey Pump Co., Tulsa. Filed May 9, 1947. Granted May 22, 1951.



Patent pertains to a device for use while welding pipelines in the exposed country of the Southwest. It is a windshield comprised of segmental duplicate sections that surround the pipe face to face. Each of the sections has a number of segments, each having a flat part in line with the axis of the pipe. Arcuate means are connected with and extend outwardly from the flat part. Flexible rubber attachments are secured to the flat parts also and are placed above the arcuate means in overhanging relation. The pliable attachments abut a duplicate rubber means on a duplicate arcuate section to provide a continuous shield around the pipe. The flexible means permit entrance to the pipe at any point. The resilient means make for connecting the number of segments of each section around the pipe.

* * *

Weld Rod Coating

2,553,132. ARTHUR T. CAPE and CHARLES V. FOERSTER, Canton, O. Assigned to Coast Metals, Inc., Canton, O. Filed Aug. 14, 1948. Granted May 15, 1951.

Patent refers to a weld rod comprising an alloy containing a metal of the iron group. It has a coating containing graphite of which particles of 325 mesh constitute less than 40% of the total graphite in the coating.

* * *

Aluminum Welding Flux

2,552,106. MIKE A. MILLER and WARREN E. HAUPIN, New Kensington, Pa. Assigned to Aluminum Company of America. Filed Jan. 15, 1949. Granted May 8, 1951.

New aluminum welding flux consists of the following non-hygroscopic salts: about 30% by weight sodium chloride, 33.5% potassium chloride, 14% lithium fluoride, 7% aluminum fluoride, 9% magnesium fluoride, 3% sodium fluoride and 3.5% alkaline earth sulfate.

NEW PRODUCTS

(Continued from page 47)

Welding Cable, Hose Meter Accurately Measures

An adaptation of the Olympic wire No. 220 and cordage meter measures both single and double welding hose in both 3/16 and 1/4 in. diameter. Welding cable in diameters up to 1 in. can be handled. The meter (Model No. 220-358) that will handle the double welding hose is pictured above.

The three dials read down as follows: 100-ft lengths to 1,000 ft, 10-ft lengths to 100 ft and 3-in. lengths to 10 ft. There are reels and stands available for use with the meter that will carry heavy insulated wire, cable or rope. Smaller reels, winders and stands can be ordered for flexible wires and light ropes.

Olympic Instrument Laboratories, Cove, Washington.

* * *

Cream Solder Joints Need No Cleaning, Tinning

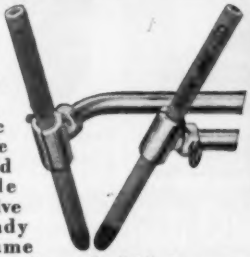
A new soldering process utilizes "Meltomatic" cream solder that is said to require no cleaning or tinning. The operator merely brushes some solder on the joint, heats it with a torch and wipes the surplus off; the joint is said to be strong and durable. Solder melts at slightly over 400 F. It is recommended for applications where dirt, oil, grease or other impurities ordinarily have to be cleaned before soldering can take place. It is also recommended for fine mechanisms such as instruments, musical instruments, cutlery and optical work.

Wayne Chemical Products Co., 9600 Copeland St., Detroit 17.

(See page 86)

★ ★ ★ BECKER

KEEN-ARC CARBONS



FOR CONSISTENTLY GOOD RESULTS

Designed to carry the high currents necessary for intense heat, BBB Keen-Arc Carbons produce a fine-grained weld of high tensile strength. They give a smooth, steady "flowing" flame which does not wander and which is concentrated at the desired focal point. Flame temperature is easily and accurately adjusted by merely changing the ampere input, and heavy copper coating permits gripping at extreme ends—eliminates frequent and periodic resetting.

A COMPLETE LINE OF CARBON WELDING SUPPLIES including carbon and graphite electrodes, carbon rods and plates, welding paste, etc.

Write for catalog.

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3450 South 52nd Ave. Cicero 50, Illinois

"HOW OFTEN DO YOU SEE STEEL SALESMEN TODAY?"

"MY SUPPLY COMPANY MAN STILL CALLS REGULARLY AND TRIES TO BE OF HELP EVEN WHEN HE DOESN'T HAVE EXACTLY WHAT I NEED."

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UNITED STATES STEEL SUPPLY COMPANY

Warehouses and Sales Offices: BALTIMORE · BOSTON
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PORTLAND, ORE. · SAN FRANCISCO · SEATTLE · ST. LOUIS · TWIN CITY (ST. PAUL)
Sales Offices: INDIANAPOLIS · KANSAS CITY, MO. · PHILADELPHIA · ROCKFORD, ILL.
TOLEDO · TULSA · YOUNGSTOWN
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USS

UNITED STATES STEEL

A CABLE WELDED IN 10 SECONDS BY CADWELD

The Cadweld Process, an outstanding method of splicing welding cable — no skill required. Salvage short lengths of cable. Powdered copper oxide and aluminum are dumped into a graphite crucible and ignited with a flint gun. The molten copper obtained from the reaction welds the cable ends together.

Connection has: No overloading, loosening or oxidation. Current carrying capacity of the weld is greater than the cable itself. Time required — less than one minute.

Welder M-364 — for No. 1 and No. 2 cable
Welder M-263 — for 1/0 and 2/0 cable
Welder M-262 — for 3/0 and 4/0 cable

For the best in lugs, quick connectors, ground clamps, and electrode holders, buy Caddy — Bulletins on request.

Trade name CADDY

ERICO PRODUCTS, INC.
2070 East 61st Place • Cleveland 3, Ohio

NO-SPAT eliminates slow, costly cleaning. Keeps adjoining surface spatter-free. Prevents rust, keeps welding jigs clean. No carbon monoxide. Send for FREE sample.

The Midland Paint & Varnish Co.
3803 E. 91st St. • Cleveland, Ohio

Small A-C Welder For Repair Shops

FOR easy and efficient repairs to light sheet metal shapes and other light gage materials, the new "General" (Model 25A) welder has 6 heat stages. Its output ranges from 20 to 100 amp and its capacity from 24 gage steel to 3/16-in. plate.

Other welders of the Precision "Shop-King" line include the "Comet" (Model 30A) for general maintenance and fabrication, the "Champ" (Model 50A), the "Powerhouse" (Model 100A) for production welding, the "Atlas" (Model 70A), the "Little Giant" (Model 20A) and the "Farm-All" Model 180B for farm and ranch work.

PRECISION WELDER MFG. CO., 660 West Grand Ave., Chicago 10.

* * *

Penoptic Markets Safety Lens Line

A companion line to the recently announced Penoptic welding lenses is now available in a complete selection of safety lenses for industrial use. They will be sold by the manufacturer direct to the industrial user at a substantial price saving.

The line includes clear and absorptive lenses in flat, 1.25 and 6.00 diopter curve lenses. Each type is available in 50 mm round, 47 mm dropeye and 44 mm dropeye sizes.

PENNSYLVANIA OPTICAL CO., Reading, Pa.

* * *

Metal and Chemical Alloy Shows Fabricating Facets

VALUABLE properties are claimed for "Chemalloy," a new alloy of metal and chemicals. It is said to resist rust and corrosion and to remain cool while being lathe-turned without coolant. It can be used for the welding of aluminum and pot metal without flux, says the manufacturer.

CHEMALLOY ASSOCIATES, Gillespie Airport, Santee, Calif.

METAL BOND
METAL BOND MFG. CO.

Offers Some Aids to Profitable Welding...

★ **ALUMINUM SOLDER**
Special solder for aluminum—drawn or cast—lynite castings, and die-cast metals. Can be used with soldering iron or under direct flame—self fluxing.

★ **HARD SOLDER**
Withstands high temperatures, heavy wear, expansion, and contraction—can be flowed in at 620° F. Use with any kind of heat.

★ **NO. 10 BRAZING FLUX**
Contains Bronze Spelter—specially prepared for brazing Malleable and Cast Iron, Steel, Brass, Bronze, and Copper. Uses lower heat—less expansion and preheating—removes oxides—flows freely. Leaves no glazed surface—easily machined and finished.

Every METAL BOND Product mentioned here as well as those described in our catalog will help you make more money on every welding job. Used by successful welders for a great many years . . . permanent good results.

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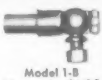
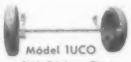


Model 1-B
Now only $4.95 Post Paid (when paid in advance)

Sell-on-sight Bull Dog Hitches . . . the ball and socket coupler that can't let go. Heavy drop forge steel construction for trailers up to 2500 pounds. Shank diameter—1⅜". Fits 1¼" pipe tongue.

AXLE ASSEMBLIES



Model 1UCO
$61.56 Less Tires F.O.B. Factory

for quicker sales! Farm-proved strength. Best built for farm implements, wagons—trailers of every kind. Includes everything except tires. Either 15" or 16" wheels.

JACK—satisfied customers bring in others. Bull Dog Jacks make easy, one-man job of parking or hitching trailers—farm implements. All steel. Heavy duty, ball-bearing swivel action. "Can't lose" crank. Complete with brackets, ready to install.

Model 60-F
Only $15.75 Post Paid (when paid in advance)

Write today for descriptive folders and price sheets. Substantial, worth-while discounts to established shops.

Hammer Blow Tool Company
Wausau 19H, Wisconsin

Gas-Fired Heating Machine Brazes Plugs in Shells

FOR special operations such as brazing plugs or adapters into ends of shell shapes or annealing the months of small shells, a new gas-fired machine speeds production rates. Two rows of burners bring the workpieces to working temperatures in a short time so that heat is confined to a small area. Rates of as high as 600 pieces per hour with a 60-in. diameter turntable have been achieved. For particular jobs, other sizes of turntables or conveyors may be used.

GAS APPLIANCES SERVICE, INC., 1211 Webster Ave., Chicago 14.

* * *

Hydraulic Remote Control Has Many Applications

FOR control applications in the resistance welder, assembly fixture or machine tool industries, a new "Superdraulic" remote control can handle 500 inch-pounds of torque. The system consists of master and slave units interconnected by two small tubes carrying hydraulic fluid. Motion applied to the actuating lever of the master unit is accurately duplicated by the slave lever. It has positive load-carrying ability in both directions. Compact and self-contained, it requires no external power.

SUPERDRAULIC CORP., 14256 Wyoming Ave., Detroit 4.

* * *

Portable Oxygen Therapy Available for Industry

FURNISHING a flow of oxygen on instant demand, a new oxygen supply unit is useful for industrial and firefighting emergencies. It has a 40-cu-ft cylinder that can supply normal oxygen needs for about 90 minutes. Cylinder is mounted on a light metal frame with a clamp. A leather handle provides for ease in handling.

MINE SAFETY APPLIANCES CO., Braddock, Thomas and Meade St., Pittsburgh 8.

* * *

Metallograph for Plants

THE Griswold OPL metallograph is said to make possible a rapid, low-cost method of structural analysis of metal samples. A large assortment of objective, oxular and projective lenses are provided for various uses. Table space is less than 12 by 12 in. and overall height is 18 in. A technician can observe the sample through binoculars or on a ground glass screen without changing his position.

F. T. GRISWOLD MFG. CO., Wayne, Pa.

DEFENSE ORDER

SILVER BRAZING NO PROBLEM WITH *Ever-Exact... Cost Cutting*

Flat or Round

"No Tangle" Notch Coil Rings

Made from SILFOS and EASY-FLO

NOW AVAILABLE IN FLAT WIRE, TOO, IN ANY THICKNESS AND DIAMETER FOR ANY SILVER BRAZING REQUIREMENT ! ! !

NEW FLAT WIRE RINGS boost production, cut costs, save time and materials . . . provide complete fill, add strength to critical joints where shape and depth of groove require more alloy . . . stress-relieved to keep ± .001-inch tolerance at all times . . . "job-design" assures that only needed amount of alloy is used . . . notch-coil eliminates tangling, cuts handling and damage, speeds assembly, aids storage and inventory . . . can be used in inner and on keyed and non-keyed outer diameters.

Prompt delivery. Approval samples submitted with all quotations

LUCAS-MILHAUPT ENGINEERING COMPANY

Save...

MONEY . . . cut silver brazing costs by 25 to 65 percent of hand-fed wire or ordinary machine-wound ring methods. Eliminate rejects, machining of brazed parts, distortion, breakage, waste or loss.

TIME . . . notch-coil permits rings to be detached individually . . . cut handling time by 25 percent. Just snap ring off coil and snap in or on assembly. Coil assures safe handling, storage, inventory.

MATERIALS . . . rings are designed to fit the job. No waste through spillage. You can save up to 45 percent in material cost alone! Just enough alloy is used to completely fill your brazing needs.

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MODEL W-46

WELDING TORCH *with*

BUILT-IN *Automatic* GASAVER

BY FAR . . . THE BEST !

WELDIT TWIN-TIP

Designed for tube brazing or welding. Flame is applied to opposite sides of work simultaneously. Uses either acetylene and oxygen or low temperature gas and oxygen.

AA . . . HEATING TIP

Multiple flame, low temperature gas and oxygen.

AA . . . HEATING TIP

Multiple flame, low temperature gas and oxygen.

Weldit INC. SINCE 1919

Actual tests prove that you will have an average gas savings of $4.80 per man, per day . . . by using the WELDIT model W-46 Torch.

This safe, speedy torch eliminates all idle flame dangers . . . adjustment valves are conveniently placed at front of handle, giving free handling of torch, and to prevent accidental contact by the operator.

The WELDIT W-46 Torch welds metal No. 28 gauge (1/64 inch) to No. 3 gauge (¼ inch) inclusive, utilizing tips . . . sizes 1 to 8, according to thickness of metal.

Call your Weldit dealer, there is one near you.

990 OAKMAN BOULEVARD, DETROIT 6, MICHIGAN

Canadian Distributor —Alloy Metal Sales—881 Bay St., Toronto 5, Ontario, Canada

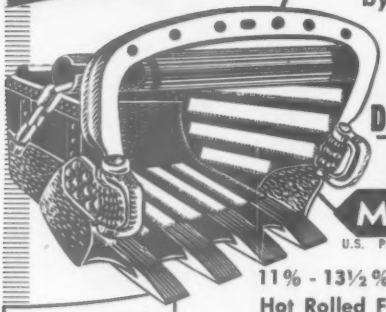
STOP Wasting Money

by SCRAPPING WORN EQUIPMENT!

Repair Worn DRAGLINE BUCKETS with . . .

MANGANAL

U.S. Patents 1,876,738—1,947,167—2,021,945



11% - 13½% Manganese-Nickel Steel Hot Rolled FLAT APPLICATOR BARS

- MANGANAL FLAT APPLICATOR BARS Save Time . . . Save Money—workharden under impact and abrasion.
- DRAGLINE BUCKETS repaired with MANGANAL often outlast new ones.
- MANGANAL Flat Applicator Bars are available in 20 sizes.
- ATTACH with MANGANAL Bare or Special Tite-Kote Electrodes for greatest strength and longest wear.

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STULZ-SICKLES CO.

SOLE PRODUCERS
92 N. J. Railroad Ave.
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SPECIAL GLOVE DEVELOPMENT BY RACINE

THREE STYLES

- 380 Horsehide
- 384 Pearl Carpincho (wildpig)
- 386 Cowhide

Chrome tanned Heat Resistant Split Leather—Heat Breaker Back Lining—LARGE size—

1. One piece back.
2. One piece palm.
3. Thumb seam protected by wide leather strap.
4. All vulnerable seams welted.
5. Palm side of thumb is protected by extra leather overlay.

• Send for booklet on these and other GARDSMEN Protective Equipment.

RACINE GLOVE COMPANY, INC.

RIO, WISCONSIN

FLASH-EX COMPOUND

Prevents adhesion of welding spatter on multipass welds or on single pass welds where heat is intense.

Also used to prevent the bonding of flash to dies and holder jaws of automatic welding machines in resistance welding.

Flash-Ex, a creamy white liquid is easily applied by any convenient means to parts that must be protected. Its use prevents imperfect welds by eliminating the possibility of spatter "shooting across" the jaws as when build-ups occur. The coating is very durable and permits many more welds between applications than ordinarily.

SPATTER-EX COMPOUND

Here is another time and cost saver that prevents bonding of welding spatter to parts which are to be welded.

Write for samples or send trial order

WAYNE CHEMICAL PRODUCTS CO.
METAL WORKING OILS & COMPOUNDS
9800 Copeland
Detroit 17, Mich.

Thermosetting Plastic for Welding Cover Plate

SUPERIOR performance is claimed for welding cover plates made of thermosetting plastic. The new plate is clear, hard and almost colorless; its surface is said to compare to polished plate glass in smoothness, lustre and chemical resistance. Says manufacturer: It will not discolor under welding conditions, will not peel, crack, blister nor shrink in service, will give up to 1,000 hours of service.

AMERICAN OPTICAL Co., Southbridge, Mass.

• • •

New Flow Interlock for Spot Welders

A NEW DEVICE that responds to a flow of water to open or close an electrical contact has been announced by General Electric's Control Divisions. This improved flow interlock closes a contact when a flow of cooling water (such as in a resistance welder) has exceeded a present amount and opens it when the flow falls below the correct amount. According to G-E engineers, the new model has a finer differential, union fittings at both ends, a bronze piston, reduced size and weight, simpler adjustment and more wiring space.

Electrical rating of the new flow interlock is 10 amp at 120 or 240 volts, a-c. Maximum line pressure that it will withstand is 125 psi.

GENERAL ELECTRIC Co., Control Divisions, Schenectady 5, N. Y.

NEW PRODUCT BRIEFS

New anti-rust paint (PCA-100) can be brushed or sprayed on rusted surfaces. It is said to penetrate through the rust into the base metal to seal the surface against further rusting. PAINT CORPORATION OF AMERICA, Fidelity Bldg., Cleveland 14.

• • •

Salt tablet dispenser for factory, shop or office holds 750 10-grain tablets, is said to be decorative to its surroundings. GENERAL SCIENTIFIC EQUIPMENT Co., 2700 West Huntington St., Philadelphia 32.

• • •

Dual purpose Model A-30 Sensitizer includes a special sensitizing attachment for readings on small appliances of ¼ hp or less. A shift of a 2-position switch and one can make readings on equipment having sealed double-conductor electric cord. PYRAMID INSTRUMENT CORP., 49 Howard St., New York City 13.

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Westinghouse Plant Saves $1,500,000 in Scrap

A SCRAP conservation program instituted at the Westinghouse Electric Appliance Division plant, Mansfield, O., is estimated to produce annual savings of $1,500,000. Last year, there were recovered for further use more than 23,000 tons of steel and 815,000 pounds of non-ferrous metals.

Such scarce and vital materials as copper, aluminum, brass, nickel and steel are culled from the appliance production line each day. Some of the material is processed for further use. To save steel, new stamping and fabricating methods (such as welding) are being instituted. Plating processes are made more efficient to save nickel and copper.

Guiding the whole program is the division's salvage department, first organized back in 1935. Ingenuity of the men on the production lines has also helped to a great extent. Employees have proposed such ideas as recovery of defective toaster platings, alternate uses for waffle grids and larger sizes of steel sheet for stampings to reduce scrap loss.

* * *

Sliding Covers Speed River Barge Loading

MOVABLE welded steel hatch covers that telescope into each other will speed loading and unloading of 20 new river barges built by Dravo Corp., Pittsburgh. Some 50% of the hold can be exposed in any location by the four pairs of strongly reinforced covers.

These 175-ft barges are used for moving steel products and other dry cargo. The new covers offer added protection from the weather since they overlap the barge coaming. This particular fleet of 20 barges, built for the Union Barge Line Corp., is designed for semi-integrated towing, each barge having one square end and one rake end. When the vessels are used together, two square ends are butted to each other to form an unbroken hull line 350 ft long. This lowers towing resistance and improves operating economy.

* * *

Reynolds Booklet Describes Aluminum Bridge Railings

ENGINEERING questions about aluminum for bridge railings are answered in a new 50-page manual written by E. J. deRidder, fomerly chief engineer of I. J. Farben Industries in Germany. Mr. deRidder is now assistant director of the products and applications department at Reynolds Metals Co., Louisville, Ky.

KEEPING U.S. TANKS IN FIGHTING TRIM
TAKES A LOT OF

ALL-STATE
All-Purpose
Cutting Electrodes

This A.C.-D.C. electrode is an important tool in the arsenal which now includes so much of American industry. *It does not require the use of oxygen.*

It is for:

(1) removing welds and rivets
(2) piercing and cutting armor plate, iron, cast iron, steel, stainless steel, copper, copper alloys, nickel, and nickel alloys
(3) gouging and veeing
(4) preparing for welding cast iron which is impregnated with grease or acid

And, it gives better results, speed and control on many metals than arc cutting with oxygen.

For complete details ask for new 32-page booklet. This is a Buyers' Guide to the complete line of ALL-STATE Alloys and Fluxes for Welding, Brazing, Soldering, Cutting and Tinning.

A-S DISTRIBUTORS EVERYWHERE

ALL-STATE
WELDING ALLOYS CO. INC.
White Plains, N. Y.

It's time we got *working* mad!

As we listen to the latest insults from Moscow, we're likely to get fighting mad.

Instead, we'd better use our heads and get *working* mad.

It is clear by now that Stalin and his gang respect just one thing—strength. Behind the Iron Curtain they've been building a huge fighting machine while we were reducing ours. Now we must rebuild our defenses—*fast.*

As things stand today, there is just *one* way to prevent World War III. That is to re-arm—to become strong—and to stay that way!

This calls for better productivity all along the line. Not just in making guns, tanks and planes, but in turning out civilian goods, too.

Arms must come first. But we must produce arms *at the same time* we produce civilian goods.

We can do this double job if we all work together to turn out more for every hour we work—if we use our ingenuity to step up productivity.

All of us must now make sacrifices for the common good. But we're working for the biggest reward of all —*peace with freedom!*

THE BETTER WE PRODUCE THE STRONGER WE GROW

A PUBLIC SERVICE PROJECT — THE ADVERTISING COUNCIL

FOR A FREE COPY OF "THE MIRACLE OF AMERICA"

MAIL THE COUPON to Public Policy Committee, The Advertising Council, Inc., Dept. B.P., 25 West 45th Street New York 19, N. Y.

Name .....

Address .....

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90c a line, minimum 3 lines. To figure advance payment, count 5 average words as a line. INDIVIDUAL EMPLOYMENT WANTED advertising rate is ½ the above rates, payable in advance.
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BOX NUMBERS count 1 line additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE
The advertising rate is $8.75 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. W.E.

NEW ADVERTISEMENTS received by August 13th will appear in the September issue, subject to limitation of space available.

PATENTS

Consultant: Z. H. Polachek
Reg. Patent Attorney
1234 Broadway, New York 1, N. Y.

ENGINEER WANTED
important European producer seeks first class engineer experienced in industrial (not chemical) applications of Butane and Propane gas, willing to go to Europe for a time in order to train technicians.
Write in duplicate stating experience in detail. Give conditions. **P-1427 Welding Engineer, 330 W. 42nd St., New York 18, N. Y.**

MANUFACTURERS REPRESENTATIVES WANTED
To handle nationally sold welders clear cover glasses—both plain and treated. Most territories open. Send full particulars concerning other lines handled, territory covered, and number of accounts therein.
RW 1405 Welding Engineer
330 W. 42 St., New York 18, N. Y.

FOR SALE
25 UNIONMELT HEADS
Complete with Controls.
PACIFIC WELDING ALLOYS MFG. CO.
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WELDING HOSE
Oxygen, acetylene, or air hose, 25' length, ¼" I. D. with couplings—$2.25 per length.
Parcel Post Prepaid. Rated firms: net 10 days. Others: Cash with order or C.O.D.
Satisfaction guaranteed.
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OXWELD REPAIR PARTS
New machine cutting parts—Heavy duty tips.
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All at Special Close-Out Prices.
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Welding Engineer
330 W. 42nd St., New York 18, N. Y.

WELDING ENGINEER

General Electric has opening for Welding Engineer

With engineering degree to work on jet propulsion engines at Lockland, Ohio (near Cincinnati) plant

SEND RESUME TO:

Technical & Supervisory Personnel
Aircraft Gas Turbine Divisions

GENERAL ELECTRIC COMPANY

920 Western Avenue
West Lynn 3, Massachusetts

STAINLESS STEEL ELECTRODES

17,500	3/32"	Page	18-8
350	3/32"	Sureweld	18-8
700	3/32"	Arcos	19-9
150	3/32"	Page	25-20
4,050	1/8"	Airco	18-8
850	1/8"	Murex	18-8
10,500	1/8"	Page	18-8
800	1/8"	Arcos	19-9
3,500	1/8"	McKay	19-9
13,500	1/8"	Arcos	25-20
26,100	1/8"	Alloyrod	19-9
8,200	5/32"	Page	18-8
10,350	5/32"	Airco	19-9
15,350	5/32"	McKay	19-9
2,050	5/32"	Arcos	25-20
4,900	5/32"	Murex	25-20
1,700	5/32"	P & H	25-20
2,800	5/32"	Raco	25-20
3,000	5/32"	McKay	19-9
18,000	5/32"	Murex	25-20
395	3/16"	Mac-Tite	19-9
24,750	3/16"	McKay	19-9
6,250	3/16"	P & H	19-9
1,300	3/16"	Sureweld	19-9
3,135	1/4"	Lincoln	19-9

1,700,000 lbs. Surplus Mild Steel Electrodes.
WRITE OR WIRE FOR PRICES
INDUSTRIAL AIR PRODUCTS CO.
3200 N. W. Yeon Avenue
Portland 10, Oregon

OXWELD CM-15s, Nat. 5s, Harris K's, Gaso S-24.
AIRCO Oxy-graph, Camographs, Radiagraphs.
SEAM WELDER, Progressive 150KVA, New.
SPOT WELDER, National, 40 KVA for Brass and Stainless.
BRONZE STAINLESS, AMPCOTRODES.
NO. 12 LENSES, ELECTRODE HOLDERS.
RALL SUPPLY CO. 110 E. 42nd St., NYC 17

IN 100-LB. LOTS, F.O.B. SCRANTON
SALE OF SURPLUS ELECTRODES

Ampco-Trode, 3/16"—210 Alum. Bronze ..... 90c-lb.
Reid-Avery, 5/16"—25/20 Stainless ..... 80c-lb.
Arcos, 1/8" - 5/32" - 3/16" Chromang 19/9 MN Type 307 Stainless ..... 60c-lb.
Murex, 5/32" 18/8 MO Stainless ..... 80c-lb.

Scranton Welding Supply Company
1301 Wyoming Avenue Scranton, Penna.

WHERE TO BUY

ALLEN FLUXES
SOLDERING
BRAZING & WELDING
L. B. ALLEN CO. INC. Chicago 31, Ill.
6714 Bryn Mawr Ave.

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STOP WELDING LOSSES *with* TWECO CABLE Connections

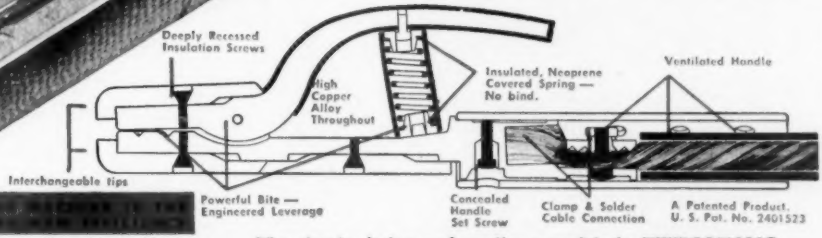
The greatest waste of profit in any weldery is caused by lost energy in the welding circuit that results in lowered production and wasted man hours. Current losses in themselves are not vital but diminished profit from poor efficiency in welding circuits IS important and warrants investigation by top management. A Tweco bulletin on "Causes and Cures" for these deficiencies is available without obligation, just write for it.

TWECOTONG Electrode Holders

- Simple design — cool running — positive rod grip in all positions
- Copper alloy construction for greater strength and efficiency

"Super-Mel" Tip Insulation

- Twecotong's "Super-Mel" tip insulators are precision molded with 30 or more layers of glass cloth impregnated with pure melamine resin binder that will not turn to carbon under heat. The same tip insulator fits both top and bottom jaws of all Twecotong models except A-532.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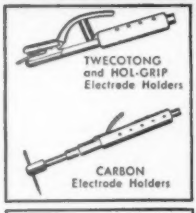
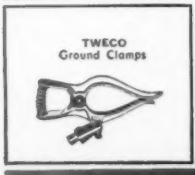
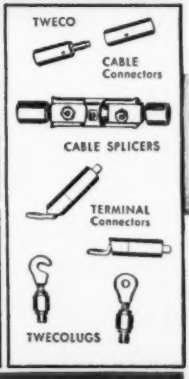
High Copper Alloy Throughout
Insulated, Neoprene Covered Spring — No bind.
Ventilated Handle
Interchangeable Tips
Powerful Bite — Engineered Leverage
Concealed Handle Set Screw
Clamp & Solder Cable Connection
A Patented Product. U. S. Pat. No. 2401523

The simple design and quality materials in TWECOTONG have been field tested for longer life, lower maintenance cost and better operator satisfaction. Save with TWECOTONG.







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Model A-38	Model A-14	Model A-316	Model A-532
500 AMPS for 3/8-3/32" rod	300 AMPS for 1/4-1/16" rod	250 AMPS for 3/16-1/16" rod	200 AMPS for 5/32-1/16" rod
$6.50	$5.00	$4.75	$4.50

Standard equipped with heavy duty "Super-Mel" insulations

Write for Twecolog 28 giving data and prices on the complete TWECO line of electrode holders, ground clamps and cable connections for electric welding.

Tweco PRODUCTS COMPANY

MANUFACTURERS OF ELECTRODE HOLDERS • GROUND CLAMPS • CABLE CONNECTIONS FOR ELECTRIC WELDING

BOSTON AT MOSLEY • WICHITA 1, KANSAS

YOUR TWECO DISTRIBUTOR CAN SUPPLY YOU

4,000,000 POUNDS OF WELD METAL...

No shutdown in 2 years!

In two years' continuous operation on a three-shift basis, these 116 A.O. Smith Heavy Duty AC Welding Machines on this auto frame line have set an amazing record of *dependability in production.* Designed and built for extreme requirements, they have accumulated nearly 15,000 hours per machine—a rugged *in-service* life-test at duty cycles up to 82%!

More than 1,000,000 auto frames were built in this period . . . more than 4,000,000 pounds of weld metal deposited by the Welding Machines shown here—*without a shutdown* caused by welding equipment failure!

The A. O. Smith Heavy Duty AC Welding Machine has *proved in use* that it will stand up under service which punishes most welding machines. We rely on it to turn out thousands of tough welding jobs—from truck frames to giant pressure vessels.

And you can rely on it for long, trouble-free service, power savings, easy operator acceptance. But *you* be the judge . . . try the welder MADE *BY* WELDERS *FOR* WELDERS.

WRITE, WIRE or PHONE for the name of your nearest distributor.

made By welders
. . . For welders!

A.O.Smith

WELDING PRODUCTS

P.O. Box 584, Milwaukee, Wisconsin

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